U.S. DEPARTMENT OF COMMERCE
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PB-261 593

Settler's Cabin Park: An Environmental Assessment of Mine Drainage Pollution

Ackenheil and Associates Geo Systems, Inc, Pittsburgh, Pa

Prepared for

Appalachian Regional Commission, Washington, D C

Jul 76

PB 261 593

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SPRINGFIELD, VA. 22161

BIBLIOGRAPHIC DATA SHEET

1. Report No. CO
ARC 76-39 4468

2.

3. Recipient's Accession No.

4. Title and Subtitle
Settler's Cabin Park
Environmental Assessment of Mine Drainage Pollution

5. Report Date
August, 1976

6.

7. Author(s)
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8. Performing Organization Rept. No. 75100

9. Performing Organization Name and Address
Ackenheil & Associates Geo Systems, Inc.
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10. Project/Task/Work Unit No.

11. Contract/[illegible] 4468
76-39-00-[illegible]8-76-I-
7 EPA-0904

12. Sponsoring Organization Name and Address
The Appalachian Regional Commission
1666 Connecticut Avenue
Washington, D. C. 20235

13. Type of Report & Period Covered Final -
Sept. 1975 - Aug., 1976

14.

15. Supplementary Notes

16. Abstracts

A study was performed to document existing environmental constraints upon land and water resources in the Settler's Cabin Park and Pinkertons Run Watershed resulting from coal mining and mine drainage pollution. The findings show that mine drainage pollution has obviated beneficial use of the streams and that unreclaimed strip mines and mine subsidence has discouraged aesthetic appreciation and recreation facilities development. A mine drainage abatement and land reclamation plan was developed based upon technical water quality criteria, cost effectiveness, land use planning and minimization of adverse impact upon the terrestrial ecosystem of Settler's Cabin Park.

17. Key Words and Document Analysis. 17a. Descriptors

Environmental Engineering
Mine Drainage Pollution Abatement
Mined Land Reclamation

17b. Identifiers/Open-Ended Terms

Settler's Cabin Park
Mined Land Reclamation for a Public Recreation Facility

17c. COSATI Field/Group

18. Availability Statement
Release Unlimited

19. Security Class (This Report)
UNCLASSIFIED

20. Security Class (This Page
UNCLASSIFIED

21. No. of Pages
86

22. Price
$5.00

FORM NTIS-35 (REV. 3-72)

USCOMM-DC 14952-P72

SETTLER'S CABIN PARK
MINE DRAINAGE POLLUTION ABATEMENT SURVEY
ALLEGHENY COUNTY, PENNSYLVANIA

August 16, 1976

Prepared for

THE APPALACHIAN REGIONAL COMMISSION
1666 Connecticut Avenue
Washington, D. C. 20235

GEO Project 75100

ACKENHEIL & ASSOCIATES GEO SYSTEMS, INC.
PITTSBURGH, PENNSYLVANIA

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ACKNOWLEDGEMENTS

This report was prepared by Ackenheil & Associates Geo Systems, Inc. for the Appalachian Regional Commission. Dr. David Maneval was the project coordinator for the Appalachian Regional Commission. Murray T. Dougherty served as projector director. The principal investigators and authors of the report were William E. Gooding and Ralph C. Witt.

The authors wish to express their appreciation to the following organizations and individuals for their assistance:

Allegheny County Department of Parks, Recreation and Conservation: David O'Loughlin, Joseph Blatt, Richard Conti, Daniel Smyksy

Allegheny County Department of Works: Richard Consentino and William Shute

Pennsylvania Department of Environmental Resources: David Hogeman

United States Geological Survey, Water Resources Division: Joseph Lescinsky

Consolidation Coal Company: G. L. Barthauer, Lloyd Price, William Black

The authors wish to acknowledge staff members of Ackenheil & Associates Geo Systems, Inc. for their assistance, particularly to Jeffrey Gross for water quality analysis; Emory McLean, Alan Egler and Thomas Farrell for abatement plan design; David Richardson for computer programming; Peter Tambellini for drafting, and Judy Ratajczak for manuscript preparation.

CHAPTER 1

INTRODUCTION

Settler's Cabin Park is a 1,500 acre park located ten miles east of Pittsburgh, Pennsylvania (see Figure 1 for the location). The park, which is owned by Allegheny County, is only partially developed for recreational purposes. Most of the park property has been deep mined and about 25% of the land has been surface mined. Consequently, much of the land is ill-suited for recreational development. Approximately 12 miles of streams within the park are polluted by mine drainage to the extent that a healthy aquatic ecosystem is impossible to maintain.

PURPOSE AND AUTHORITY

This study was performed under a grant from the Appalachian Regional Commission. The study was authorized by Contract No. 75-57 between the Appalachian Regional Commission and the Environmental Protection Agency. The purpose of the investigation was to locate and assess the severity of mine drainage pollution and to provide recommendations for pollution abatement.

SCOPE OF STUDY

Investigation included the collection of maps and literature from various sources. Topographic and land use maps were obtained from the United States Geological Survey and from the Allegheny County Department of Parks, Recreation and Conservation. A NASA high altitude aircraft false color infrared photograph of the park was also obtained from the U.S.G.S. Deep mine maps were obtained from Consolidation Coal Company. All maps were eventually transposed into a scale of 1 in. equals 500 ft. for the preparation of inventory and base maps which were designed to show surficial features and cultural aspects.

A field investigation was performed to locate and sample mine drainage discharges. Twelve deep and strip mine discharges were known from the Chartiers Creek Mine Drainage Pollution Abatement Survey, which was published in 1970. (1) A total of 80 mine drainage discharge points and stream monitoring stations were located by the field crews. However, most of the mine drainage discharges were located during the period of high ground water and subsequent high mine flows. Consequently, for the purpose of routine sample collection and monitoring for 13 weeks, the sampling program was reduced to include 49 samples. Of the 49 samples, 25 were from localized mine drainage discharge points and 24 were established as stream monitoring stations. Grab samples were obtained at each station and were analyzed in our laboratory for pH, acidity, alkalinity, total and ferrous iron, sulfates and aluminum. In addition, 17 stream samples were collected and analyzed for biochemical oxygen demand (BOD) as a possible indication of organic pollution. All grab samples were obtained with a corresponding flow measurement.

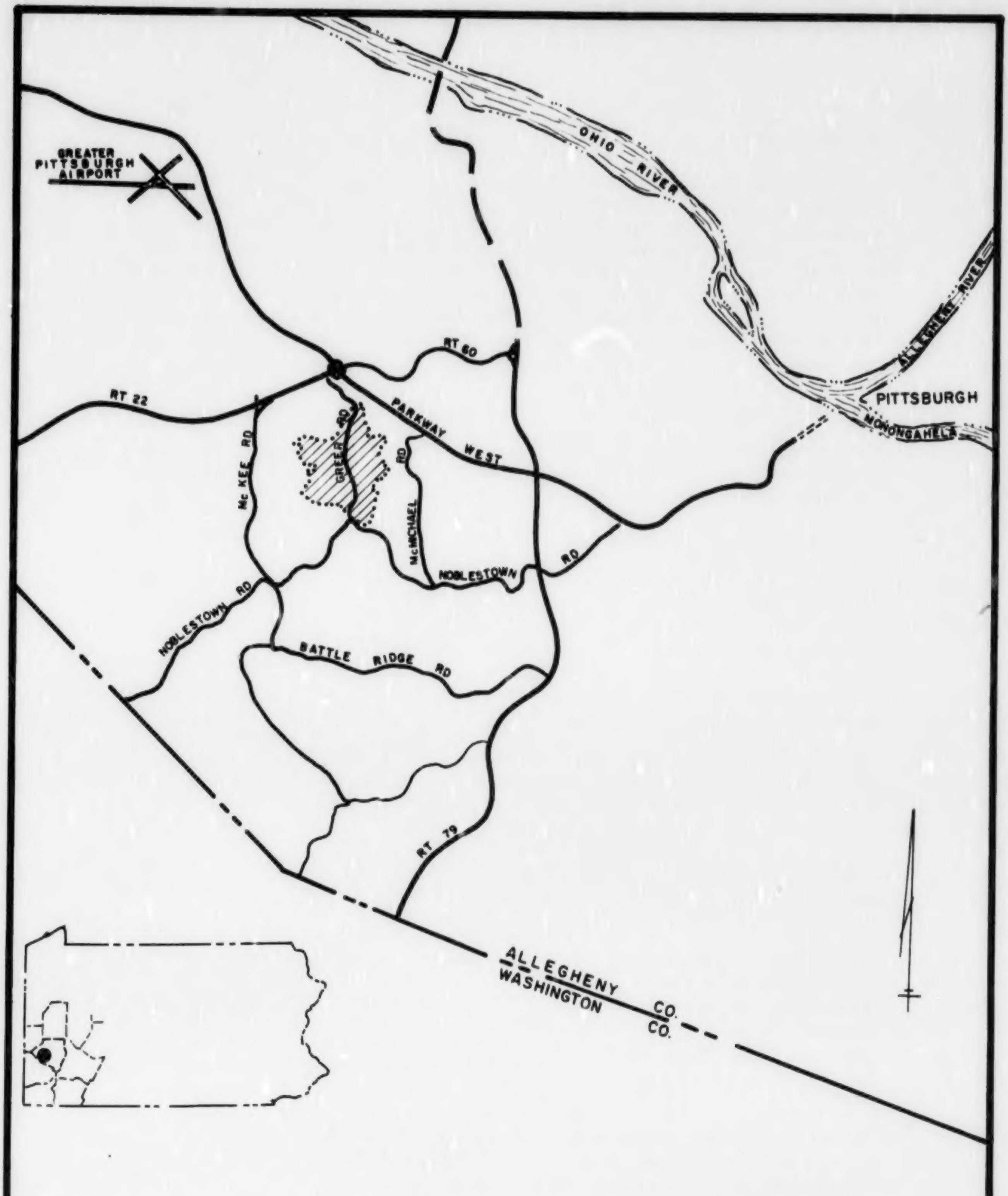

GREATER PITTSBURGH AIRPORT
OHIO RIVER
ALLEGHENY RIVER
PITTSBURGH
MONONGAHELA
RT 60
RT 22
PARKWAY WEST
McKEE RD
GREER RD
RD
McMICHAEL
NOBLESTOWN RD
NOBLESTOWN RD
BATTLE RIDGE RD
RT 79
ALLEGHENY CO.
WASHINGTON CO.

Figure I LOCATION MAP

An additional field survey was initiated to collect data necessary to provide both recommendations and cost estimates for abatement methods. Surface features related to deep and strip mining were documented, photographed and sketched. Related surface features included high walls, spoil banks, areas of restricted drainage and depressions, mine subsidence areas, slopes, erosion and degree and quality of vegetation. The field investigation was coupled with a detailed engineering analysis of the causes of the mine drainage pollution in the study area. This analysis used data obtained from detailed field reconnaissance, together with deep mine maps, maps showing coal outcrops, strip mines, and structure contours of the Pittsburgh coal.

Although the original objective of this project did not consider any secondary objectives to mine drainage abatement, it was difficult to propose recommendations for improving water quality without considering other factors influencing those recommendations. Because the survey area is located primarily in an Allegheny County Regional Park, the recommendations for mine drainage pollution abatement considered any development or planning by Allegheny County for Settler's Cabin Park. For this reason, information on park planning was obtained from the Allegheny County Department of Planning and Development of the Department of Parks, Recreation and Conservation.

The objectives of the project were then modified to encompass not only feasible mine drainage abatement recommendations, but also the enhancement of aquatic and terrestrial ecology and aesthetics of the park to generally upgrade it as a recreational facility.

Keeping these multiple objectives in mind, several mine drainage abatement methods were evaluated and screened. Those selected as technically and economically feasible were then evaluated using criteria of water quality, ecology, total cost, cost effectiveness, aesthetics, and land use plans. From this evaluation a final plan was selected which was designed to suboptimize the multiple objectives stated above. The selected plan was then described in greater detail to yield a preliminary environmental impact assessment. Finally, a recommended sequence of implementation based on work area priorities was developed.

PRIOR REPORTS

The mine drainage problem within the project area was initially documented in the Chartiers Creek Mine Drainage Pollution Abatement Project which was published in 1970. (1)

The Chartiers Creek study identified five mine drainage pollution sources within the Pinkerton's Run Watershed which affected streams within the park boundaries. Seven additional acid mine drainage (AMD) discharges were identified to the west and southwest of the park. These 12 AMD sources drained into the Robinson Run and the North Branch of Robinson Run Watersheds. One of the 12 discharges, source number 4688, was classified as a major source, the criteria for this classification being 1,000 lbs. per day of acidity at the time of its maximum measured flow.

The abatement plan of the Chartiers Creek report centered around the 43 major discharges which were identified during the study through the Chartiers Creek Basin. Consequently, the only abatement work recommended for the Settler's Cabin Park-Pinkerton's Run Watershed study area was reclamation associated with major source 4688.

Four reclamation projects were recommended for the area associated with major source 4688. The recommendations consisted of improving the drainage throughout four abandoned strip mines and closing one deep mine opening. All four reclamation projects were designed under Commonwealth of Pennsylvania, Department of Environmental Resources Project SL 102-7-20. Two of the projects associated with strip mines, OAK 48 and OAK 58 (Chartiers Creek Pollution Survey designation), are currently under construction and are expected to be completed by May, 1976. The other two projects were not implemented because of failure to obtain property easements.

CHAPTER 2

DESCRIPTION OF THE STUDY AREA

The description of the study area included in this chapter encompasses not only Settler's Cabin Park but also privately owned property around the periphery of the park. This slightly expanded study area was developed because of the difficulty of analysis of mining, related surface features, and mine drainage discharge points within a confined area. Actually, most of the deep mines that contribute to mine drainage within the park extend beyond the park boundary.

The study area is contained within the Robinson Run Watershed. Pinkerton's Run originates outside Settler's Cabin Park in North Fayette Township and flows through the park before discharging into Robinson Run, and ultimately Chartiers Creek. The location is shown on Figure 2, along with the major drainage basins of the area.

NATURAL RESOURCES

TOPOGRAPHY

The Pinkerton's Run study area is part of the Allegheny Plateau geomorphic province. The rock strata encountered are essentially horizontal. The landscape is an erosional one where valleys have been carved by streams downcutting through layers of sedimentary rock. Land areas between valleys remain as topographic highs but have a moderately rounded appearance due to weathering and erosional forces. The valley wall slopes generally range from about 25% to about 40% while the rounded valley divides have more gentle slopes ranging from about 4% to about 10%. The maximum relief of the study area is roughly 400 ft. The Pittsburgh coal seam outcrops along valley walls within the project area. The coal had great economic value and has been extensively deep and strip mined resulting in altered land forms.

GEOLOGY

The sedimentary rock strata outcropping in the Pinkerton's Run study area are of Pennsylvanian age. The rock types generally encountered are interbedded sandstone, shale, limestone and coal. The rock strata are members of the Monongahela and Conemaugh Groups. The contact between these two groups marks the position of the economically valuable Pittsburgh coal seam. A generalized columnar section showing the rock units exposed in the study area appears in Figure 3.

The strata exposed in the study area dips slightly toward the south. Structure contours on the base of the Pittsburgh coal seam reflect the gentle southward dip and are shown on the Inventory Map appearing in the rear pocket of this report.

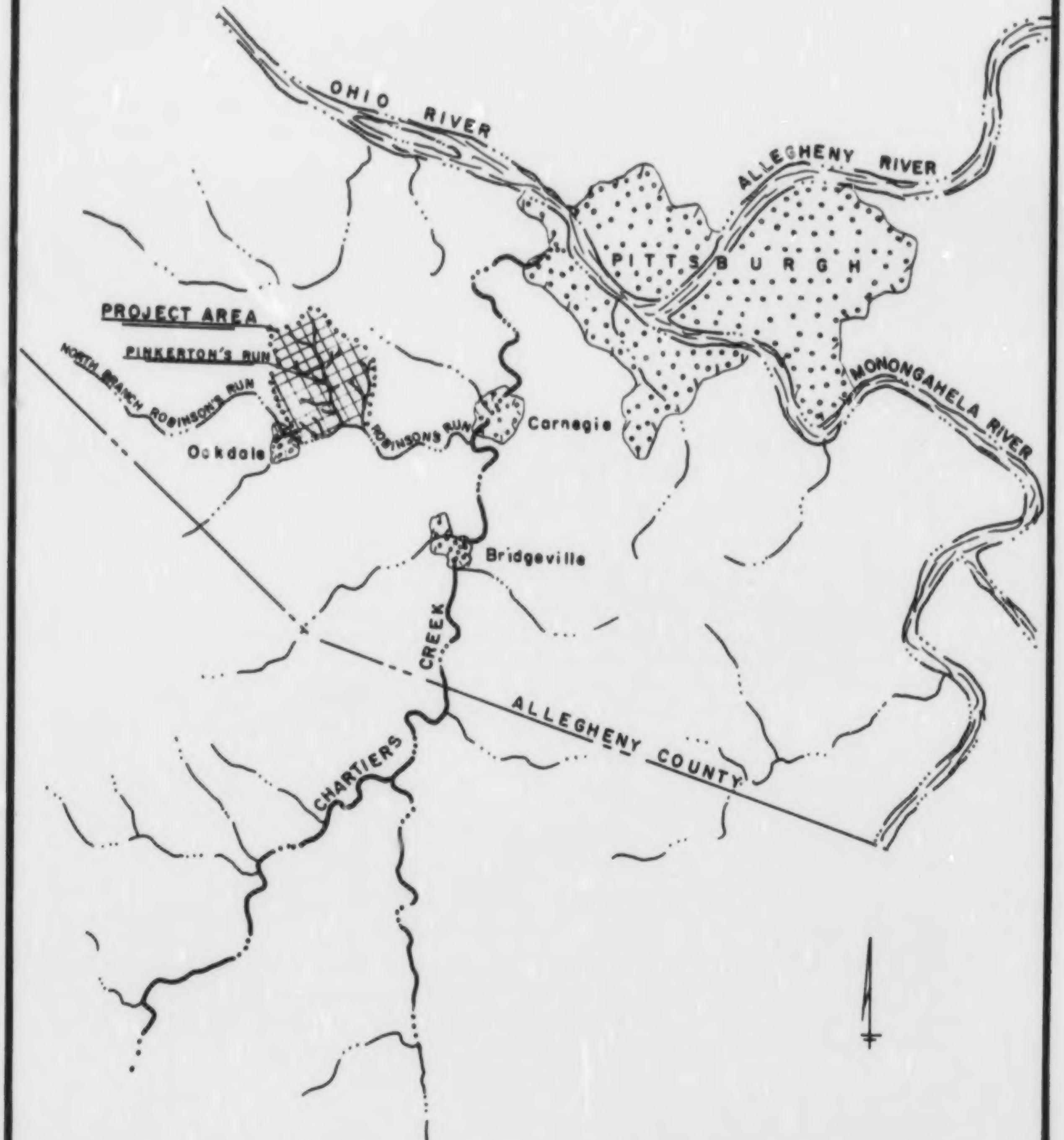
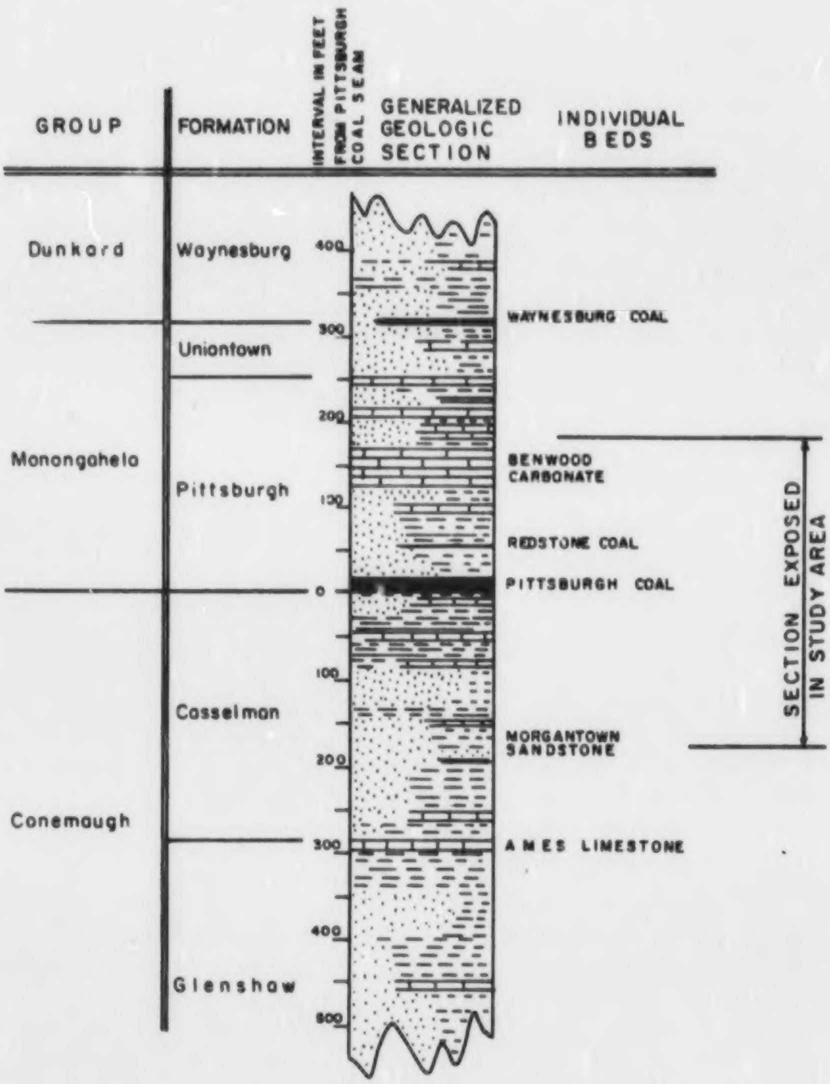

OHIO RIVER
ALLEGHENY RIVER
PITTSBURGH
PROJECT AREA
PINKERTON'S RUN
NORTH BRANCH ROBINSON'S RUN
ROBINSONS RUN
Carnegie
Oakdale
Bridgeville
MONONGAHELA RIVER
CREEK
CHARTIERS
ALLEGHENY COUNTY

Figure 2 PROJECT AREA LOCATION MAP SHOWING PROMINENT RIVERS and STREAMS


GROUP
FORMATION
INTERVAL IN FEET FROM PITTSBURGH COAL SEAM
GENERALIZED GEOLOGIC SECTION
INDIVIDUAL BEDS
Dunkard
Waynesburg
Uniontown
Monongahela
Pittsburgh
Conemaugh
Casselman
Glenshaw
400
300
200
100
0
100
200
300
400
500
WAYNESBURG COAL
BENWOOD CARBONATE
REDSTONE COAL
PITTSBURGH COAL
MORGANTOWN SANDSTONE
AMES LIMESTONE
SECTION EXPOSED IN STUDY AREA

DATA FROM: GEOLOGY OF THE PITTSBURGH AREA
GENERAL GEOLOGY REPORT G-59
Published By PA. GEOLOGICAL SURVEY

Figure 3 GENERALIZED COLUMNAR SECTION

SOILS

Soil associations are groups of soils which ordinarily occur together in the landscape. Each soil has a characteristic location depending on the land slope and material from which it was derived. The soil associations are named in order of their importance within the association. For instance, the Westmoreland-Guernsey soil association is composed primarily of Westmoreland soils with secondary amounts of Guernsey soils, as well as other minor soils. (4) The Pinkerton Run study area generally exhibits two soil associations. These soil associations and a brief general physical description of each are listed on the following table:

Soil Association	Description
Westmoreland-Guernsey-Clarksburg	Soils have developed in material derived from weathered shales, sandstones and limestones. Slopes range from gentle to steep, but are mostly moderate.
Westmoreland-Guernsey	Soils have developed in material derived from weathered shales, sandstones and limestones. Slopes are steep.

Each soil series takes into account several physical characteristics, each partially determining their potential erodibility. The potential soil erodibility for any location can be estimated by combining the physical soil characteristics with the slopes on which they are found. Potential soil erodibility applies to areas disturbed by the activites of man, such as strip mining. In general, the potential erodibility of the existing soil associations within Settler's Cabin Park is estimated as high, except in flat or moderate slope areas where the potential erodibility is estimated as medium.

WATER

Water Quality: The water quality of the Settler's Cabin Park area is affected primarily by acid mine drainage. In an underground mine, water percolates through the overburden and contacts pyrite in the strata lying above the coal (usually carbonaceous shales and sandstone). The water then flows along the floor of the mine and eventually discharges at an outcrop or exposed entry or, in some cases, rises to the surface under artesian pressure. All but two of the 25 documented acid mine drainage discharges routinely collected during the sampling period were gravity drained deep mine discharges. The remaining two acid discharges resulted from an unreclaimed strip mine in which runoff becomes entrapped in depressions and contacts acid forming strip mine spoil material.

Acid mine drainage most seriously effects Pinkerton's Run and its major tributaries which are continuously polluted. The streams monitored by SR-3 and SR-4 are also continuously polluted by acid mine drainage. The least affected stream is monitored by station SR-6, its eastern tributary monitored by SR-16 is relatively clean, while the western branch monitored by SR-5 is intermittently affected by acid mine drainage. The effect of acid mine drainage pollution on the aquatic life of the project area is significant. A comparison of the chemical water quality during the study and the concentrations required to sustain viable fish populations provide little or no likelihood that fish live within the park. A possible exception would be upstream of station SR-16 where the chemical water quality during the sampling period remained acceptable. The location of the stream sampling stations is shown on the Inventory Map found in the inside rear cover pocket.

No evidence was found to indicate either organic or industrial pollution. Seventeen BOD (Biochemical Oxygen Demand) tests were conducted at selected stream locations throughout the project area. These tests revealed a high level of dissolved oxygen, which normally indicates little or no organic enrichment.

Water Supply: The Pinkerton's Run study area is partially serviced by the West Allegheny County Municipal Authority. (10) Homes located along Pinkerton Run Road receive service from the Authority. The municipal water treatment plant has a design capacity of .7 million gals. per day, but only used an average volume of .223 million gallons per day in 1973. No water wells were known to exist in the project area, according to data available in 1973. (6)

Ground Water: The major water bearing beds which are potential sources of water supply in the Pinkerton's Run study area are the Pittsburgh sandstone, Connellsville sandstone and Morgantown sandstone. The reliability of the Pittsburgh sandstone, which overlies the Pittsburgh coal, is questionable as a water source in the study area. This is because the Pittsburgh coal has been extensively mined and subsequent subsidence of the overlying strata has probably drained the aquifer. The Morgantown sandstone, which lies roughly 150 to 220 ft. below the Pittsburgh coal, is the best and most persistent aquifer in the area for domestic uses, and is permeable enough to sustain some public water supplies. The Connellsville sandstone is not as reliable an aquifer in the study area as the Morgantown sandstone. This is because the Connellsville sandstone, which lies 30 to 60 ft. below the Pittsburgh coal, is more shaley and thus less permeable. However, sandstones which are not shaley are generally permeable enough to sustain domestic needs. (7)

Unconsolidated deposits of alluvium on the flood plain of Pinkerton's Run could prove to be a source of water. The water bearing potential of the unconsolidated flood plain material is dependent on its thickness and lithology and warrants further study.

MINING HISTORY

Deep mining activities in the general area of the Pinkerton's Run Watershed roughly covered the years 1908 through 1937. Mining operations were conducted using the room and pillar method where drift entries were driven to provide access to the coal. The coal was then mined from room size areas leaving pillars of coal in place to provide roof support. This phase of the mining operation occurred roughly from 1913 to 1932.

The final phase of mining involved the recovery of the coal pillars as deep mining operations concluded. Most of the mining was done under shallow cover causing localized subsidence and subsequent disruption of surface and subsurface drainage patterns. The numerous mine openings in the area were usually left unsealed, allowing water and air to enter the mine complex which contributed to the acid mine drainage problem. The extent of deep mining is illustrated on Figure 4.

Strip mining operations were primarily conducted in the 1940's. The coal left in place by previous deep mining was entirely stripped from the coal outcrop following the contours of the land surface. Many of these strip mines were improperly reclaimed and now provide a means for surface water to enter the deep mine where it can discharge as acid mine drainage. No strip or deep mines are currently in operation within the watershed.

SETTLER'S CABIN PARK

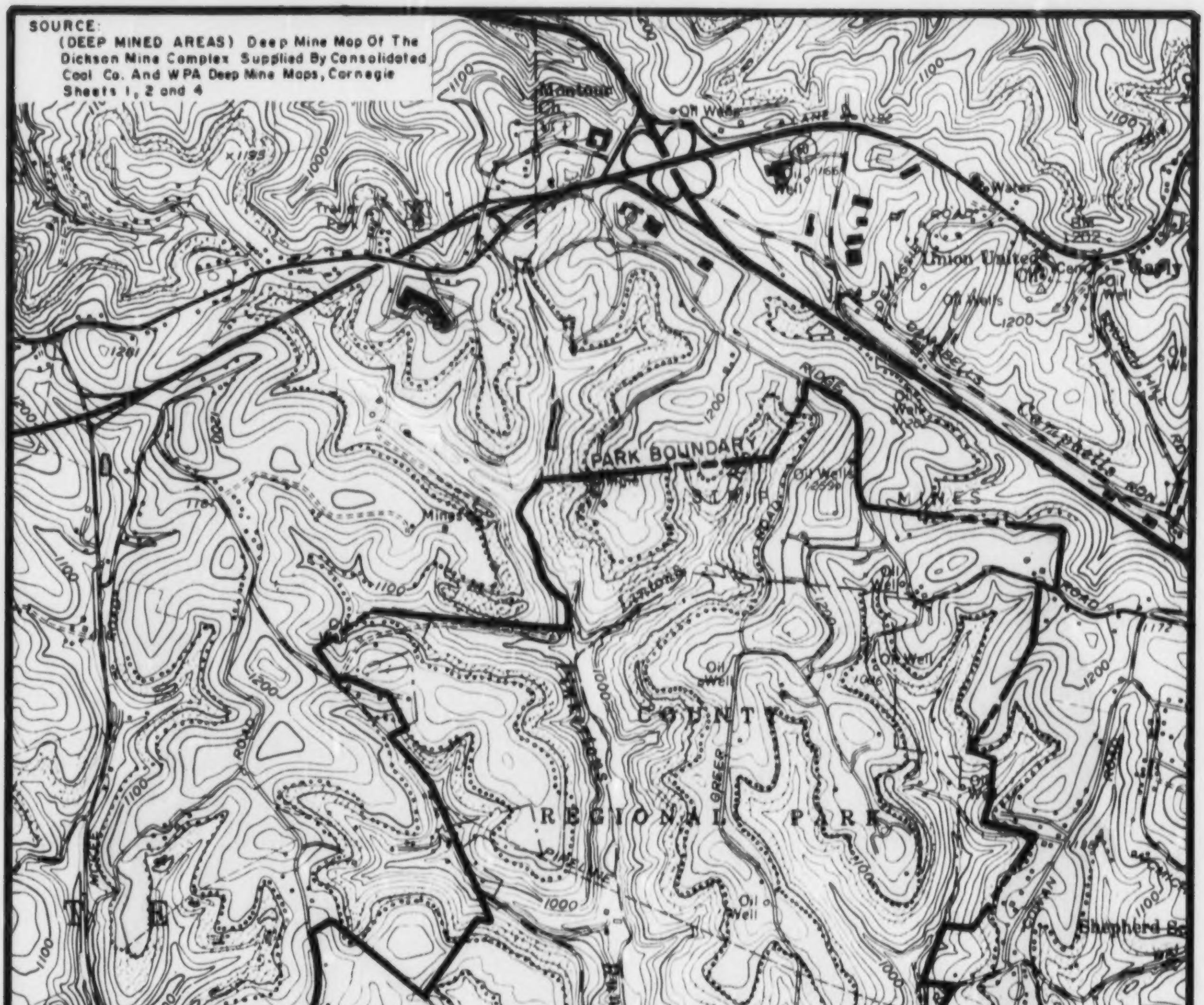
Settler's Cabin Park is one of a series of regional parks operated by Allegheny County. The park is named for an 18th Century log cabin which has been restored as a tourist attraction.

EXISTING FACILITIES

Settler's Cabin Park was open to the public in 1968. Approximately 400 acres have been developed and devoted to passive recreation. The existing recreational facilities are shown on Figure 5 and consist of picnic areas with ballfields and hiking trails. The park is open to the public year round and all facilities are free. Approximately 110,000 patrons visit the park in the peak months of June through September. (2) The primary natural facility of the park is its vegetation. Its importance in park planning is second to none. Vegetation supplies shade, aesthetic beauty, cover and food for animals, and erosion control. Relatively mature trees and woodlands within the park are generally found in the lowlands along streams. The most conspicuous species include Oak, Black Cherry, Locust, Beech and Maple. On hillsides and hilltops the vegetative cover consists mainly of saplings and young Locust, Quaking Aspens, or Pines. Since the park area has been extensively contour strip mined, many of these trees are growing on reclaimed strip mine spoils. Before the coal mining boom in the area began in the early 1900's, farms blanketed the land. Today, second growth, naturally seeded trees cover the abandoned farm land. Prominent among these are Crabapple, Locust, Birch, and Black Cherry. A variety of grasses and shrubs throughout the park and vicinity provide food and cover for game animals such as rabbits, pheasant, deer, etc.

PARK PLANNING AND DEVELOPMENT

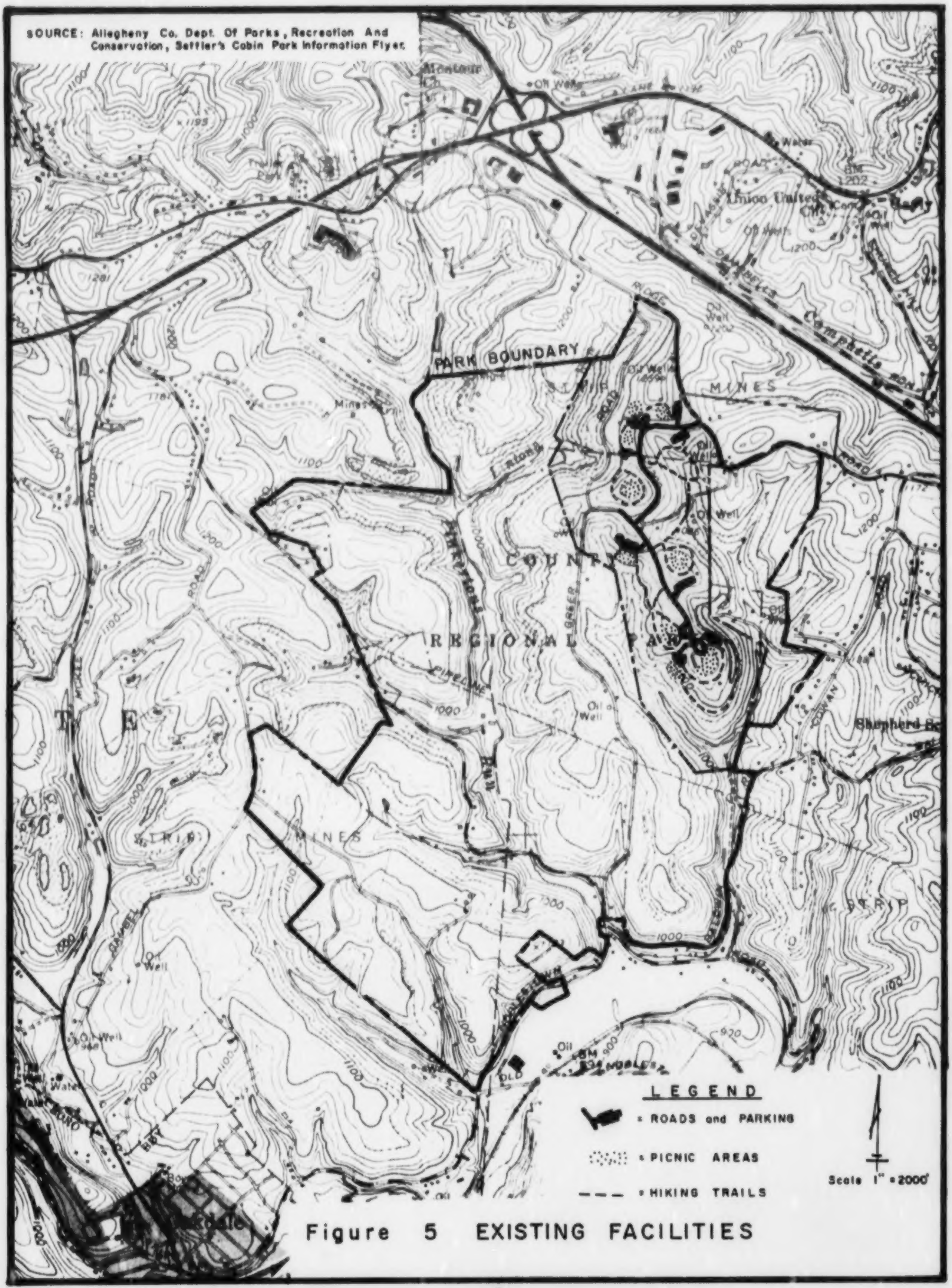
The next stage (or Phase II) of development for Settler's Cabin Park calls for the construction of 11 additional picnic sites similar to the existing sites (9) with open field play areas. However, the original landscape architect's conception of proposed facilities contains plans for several other recreational features. Some of the features include a camping area, an animal shelter, a bird sanctuary, a game refuge, a wild flower preserve, an arboretum, scenic lookouts and fishing areas. These proposed facilities are shown on Figure 6.


Montour Ch.
Oil Wells
Union United
Oil Wells
Campbells Run Road
PARK BOUNDARY
STRIP MINES
Oil Well
COUNTY REGIONAL PARK
STRIP MINES
Oil Well
Shepherd
STRIP
Oil
BM 894 NOBLESTOWN RD
Gregg
COAL
1000
1100
1200
900

SOURCE:
(DEEP MINED AREAS) Deep Mine Map Of The Dickson Mine Complex Supplied By Consolidated Coal Co. And WPA Deep Mine Maps, Carnegie Sheets 1, 2 and 4

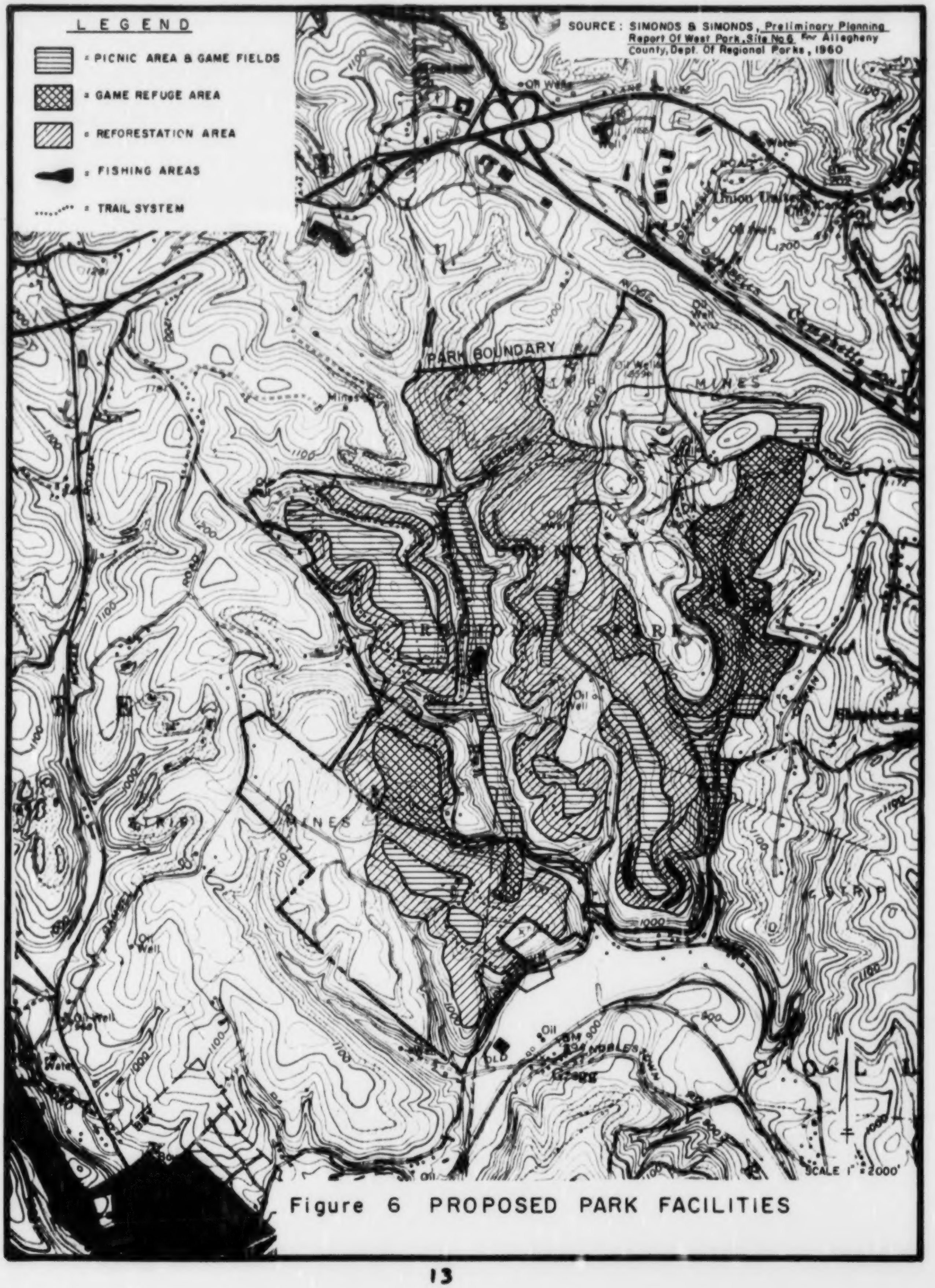
Figure 4 DEEP MINED AREAS

SCALE 1" = 2000'


Montour Ch.
Oil Well
Union United Ch.
Campbells Run Road
PARK BOUNDARY
STRIP MINES
COUNTY
REGIONAL PARK
PIPELINE
STRIP MINES
STRIP
Shepherd
Oil Well
LEGEND
= ROADS and PARKING
= PICNIC AREAS
= HIKING TRAILS
Scale 1" = 2000'

SOURCE: Allegheny Co. Dept. Of Parks, Recreation And Conservation, Settler's Cabin Park Information Flyer.

Figure 5 EXISTING FACILITIES


LEGEND
▤ = PICNIC AREA & GAME FIELDS
▦ = GAME REFUGE AREA
▨ = REFORESTATION AREA
= FISHING AREAS
= TRAIL SYSTEM
PARK BOUNDARY
MINES
STRIP MINES
REGIONAL PARK
Oil Well
Union
COAL
SCALE 1" = 2000'

SOURCE: SIMONDS & SIMONDS, Preliminary Planning Report Of West Park, Site No 6 for Allegheny County, Dept. Of Regional Parks, 1960

Figure 6 PROPOSED PARK FACILITIES

Two major constraints currently affect the proposed development. The first of these constraints is the availability of funds. Construction for Phase II of the park development was planned in 1970. However, since that time, there has been no further development due to fiscal limitations and relegation of the plans to a low priority within Allegheny County's Department of Parks, Recreation and Conservation.

The second constraint is the environmental damages resulting from deep and strip coal mining. The strip mining occurred from the late 1940's and until the early 1960's. The stripping methods consisted of following the contours of the valley walls along the Pittsburgh coal outcrop. About 60% of the strip mines were partially reclaimed by backfilling the pit area and forming a flat bench. The remaining strip mines were left unreclaimed with highwalls and depressions left intact, except for three stripped areas which have been adequately reclaimed and reshaped to the land's approximate original contour. The strip mined land within the study area is shown on Figure 7.

Other land use constraints are the numerous subsidence areas. These areas result from deep mining under shallow cover causing roof collapse and subsequent surface subsidence. Large portions of the park are only 20 to 60 ft. above the abandoned mine workings and surface subsidence is evident throughout many of these areas. The subsidence areas are illustrated on Figure 8. These subsidence areas pose a serious constraint upon developing picnic areas and ballfields, not only because of the expense of filling the sinkholes, but because the area should still be considered subsidence prone.

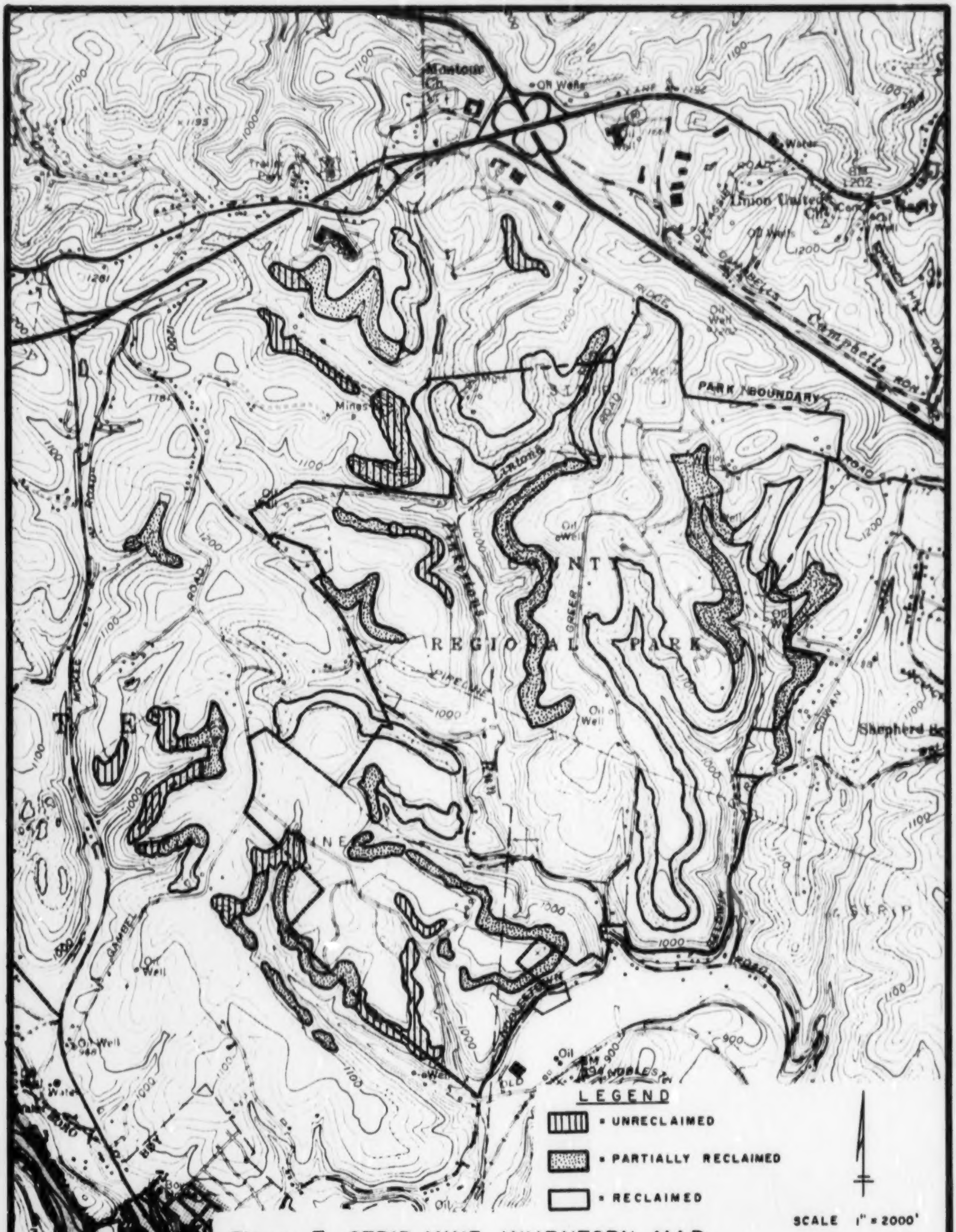

LEGEND
▥ = UNRECLAIMED
▒ = PARTIALLY RECLAIMED
☐ = RECLAIMED
SCALE 1" = 2000'
Montour Ch.
Union United Ch.
Campbells Run
PARK BOUNDARY
REGIONAL PARK
PIPELINE
Mines
Oil Well
Shepherd

Figure 7 STRIP-MINE INVENTORY MAP

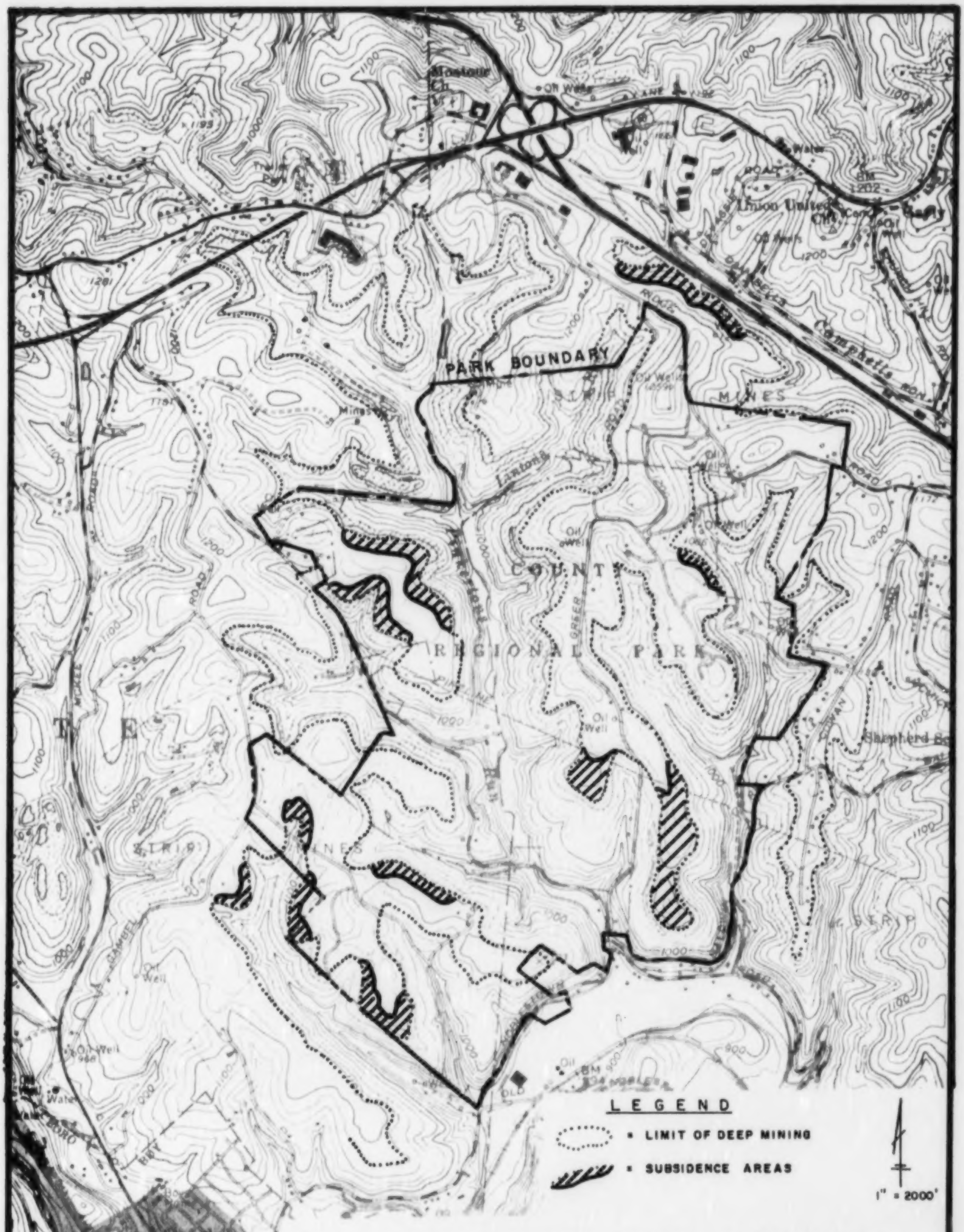

PARK BOUNDARY
STRIP MINES
COUNTY
REGIONAL PARK
Linton
Union United Ch
Campbells Run
Oakdale
Oil Well
LEGEND
= LIMIT OF DEEP MINING
= SUBSIDENCE AREAS
1" = 2000'

Figure 8 AREAS AFFECTED BY MINE SUBSIDENCE

CHAPTER 3

PROBLEMS

The stream and nearby tributaries of the Pinkerton's Run Watershed were found to be seriously degraded by mine drainage. From December, 1975, through March, 1976, a total of 52 mine drainage sources were located and identified throughout the study area. Sources with the prefix PR were located and identified during the current study and all other sources (e.g. 4688) were located and identified during the Chartiers Creek project. Twenty-seven of the sources discharging less than 5 gpm were eliminated to simplify the application of a monitoring program. Locations of the remaining 25 mine drainage sources are shown on the Inventory Map contained in the inside rear pocket and on Figure 9.

MINE DRAINAGE POLLUTION SOURCES

The monitoring program for the 25 mine drainage sources consisted of weekly flow measurements and water sampling. Samples were analyzed in the laboratory for pH, alkalinity, acidity, total iron, ferrous iron, sulfates and aluminum. Results of the 13 weekly samples taken at each source indicate that 23 sources were net acidic, 2 were net alkaline, and 17 had total iron concentrations above the 7 mg/1 recommended standard for Pennsylvania Mine Drainage Permits. The alkaline discharges were determined not to be mine drainage, but natural springs. Average flow, pH, acidity, alkalinity, total iron, aluminum and sulfates are tabulated on Table 1. A complete listing of all analysis and material load data is contained in Appendix A. Location of the AMD discharges are shown on Figure 9 and on the Inventory Map.

The 25 discharges which were sampled for 13 weeks contributed an average of 4,996 lbs/day of acid and 256 lbs/day of iron to the study area streams. Of the total 25 AMD sources, 23 originated from abandoned deep mines and 2 discharges (PR-5 and PR-6) originated from an abandoned strip mine. Deep mine discharges accounted for 4,796 lbs/day or 95% of the total documented net acidity load of all the sampled AMD sources within the study area. Pinkerton's Run received an average net acid load of 1,575 lbs/day from 11 AMD sources, or 31% of the total documented net acid load for the study area.

Source 4675, located near the headwaters of the unnamed tributary monitored by Station SR-4, was the greatest acid contributor of all sampled sources having an average net acidity load of 855 lbs/day. The greatest average total iron load (40 lbs/day) was from Source 4681, located immediately north of Oakdale, Pennsylvania, with an average concentration of 49.1 mg/1 and an average flow of 67 gpm. Table 2 contains descriptions of the acid mine drainage discharges.

THE EFFECT OF ACID MINE DRAINAGE UPON STREAM QUALITY

Water quality and discharge rates of 24 stream stations throughout the study area were monitored on a weekly basis from December, 1975, through March, 1976. The stream monitoring stations were designated with the

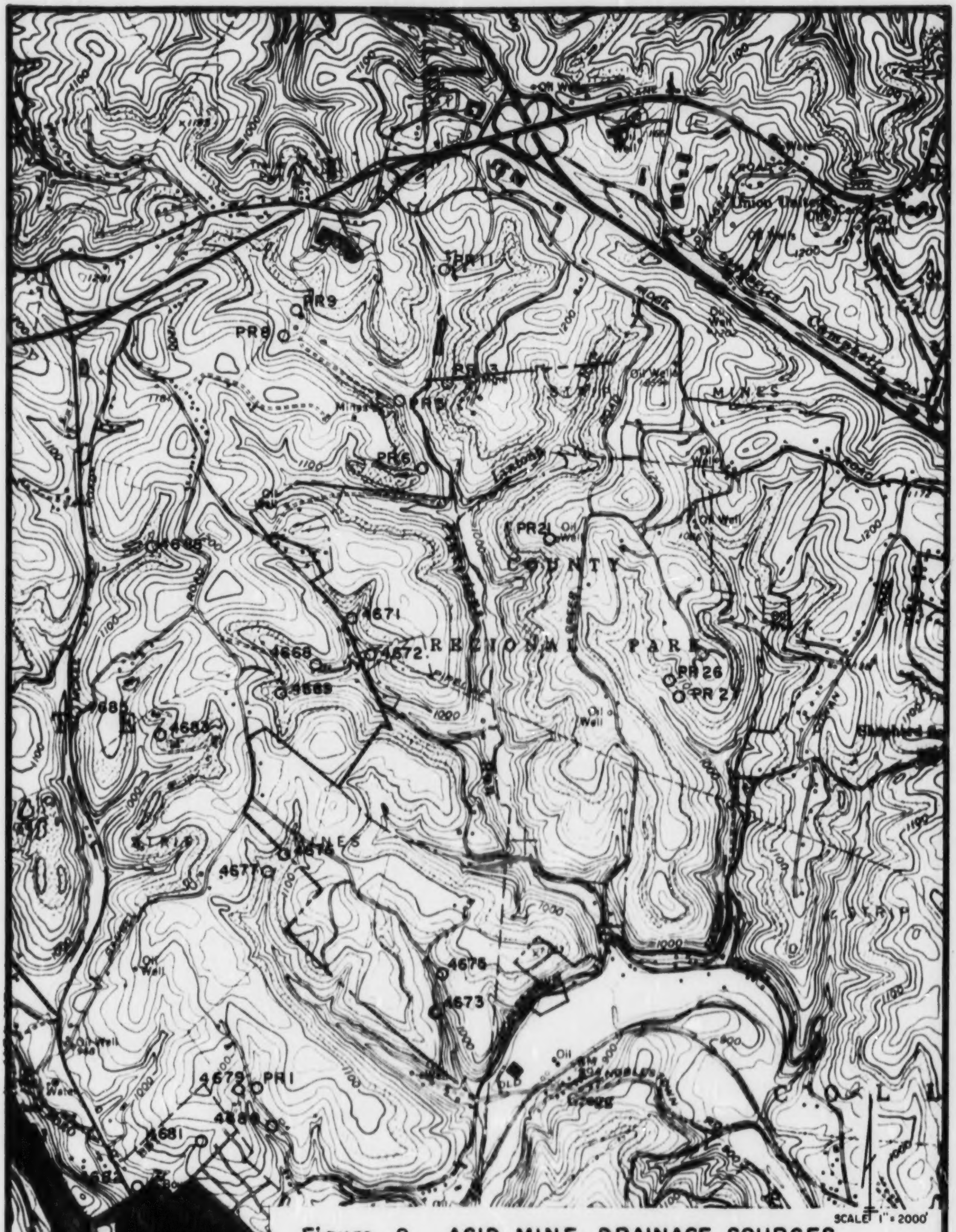

PR11
PR9
PR8
PR3
PR5
PR6
PR21
4666
4671
4668
4672
4669
4685
4683
PR 26
PR 27
4676
4677
4675
4673
4679
PR1
4680
4681
4682
COUNTY
REGIONAL PARK
MINES
STRIP
COAL
Oil Well
Union University
Gregg
SCALE 1" = 2000'

Figure 9 ACID MINE DRAINAGE SOURCES LOCATION MAP

TABLE 1

LABORATORY ANALYSIS AND MATERIAL LOAD SUMMARY
MINE DRAINAGE SOURCE AVERAGES

Source	Flow (gpm)	Lab pH	Net Alkalinity* mg/1	Net Alkalinity* lbs/day	Total Iron mg/1	Total Iron lbs/day	Aluminum mg/1	Aluminum lbs/day	Sulfate mg/1	Sulfate lbs/day
PR-1	21	6.2	76	19	2.3	1	1.0	0	211	53
PR-5	24	2.1	-616	-177	72.2	21	44.2	13	1,049	302
PR-6	6	2.1	-760	- 56	112.0	8	50.9	4	1,103	81
PR-8	17	6.1	95	19	1.3	0	1.8	0	139	28
PR-9	116	2.9	-197	-274	3.9	6	18.8	26	545	761
PR-11	45	2.3	-189	-101	5.3	3	10.8	6	657	353
PR-13	12	2.4	-374	- 54	22.8	3	24.9	4	982	142
PR-21	11	3.7	-201	- 27	3.7	1	16.8	2	604	82
PR-26	23	2.9	-306	- 84	7.3	2	19.4	5	679	186
PR-27	20	2.7	-288	- 70	5.7	1	19.8	5	635	154
4668	57	2.4	-315	-217	18.5	13	26.2	18	728	502
4669	85	2.8	-305	-312	4.5	5	23.2	24	746	765
4671	41	3.1	-385	-188	23.3	11	24.8	14	1,019	498
4672	41	3.1	-385	-188	23.3	11	30.5	15	1,019	498
4673	33	2.2	-396	-156	31.3	12	21.0	8	527	207
4675	138	2.5	-516	-855	20.4	34	46.5	77	899	1,480

*Net Alkalinity = Total Alkalinity - Total Acidity

TABLE 1
(cont'd)
LABORATORY ANALYSIS AND MATERIAL LOAD SUMMARY
MINE DRAINAGE SOURCE AVERAGES

Source	Flow (gpm)	Lab pH	Net Alkalinity		Total Iron		Aluminum		Sulfate	
			mg/1	lbs/day	mg/1	lbs/day	mg/1	lbs/day	mg/1	lbs/day
4676	44	2.8	-243	-127	8.5	9	16.4	9	503	264
4677	50	2.3	-304	-184	19.2	13	21.0	13	558	338
4679	5	3.0	-393	- 25	26.8	2	38.4	2	845	55
4680	31	2.1	-829	-306	90.4	19	52.7	19	1,041	385
4681	67	2.9	-434	-349	49.1	36	44.6	36	971	781
4682	67	3.3	-298	-241	20.3	21	26.1	21	742	600
4683	93	2.4	-299	-334	5.0	23	20.5	23	672	751
4685	85	3.7	-239	-244	8.3	17	16.9	17	796	813
4688	187	3.0	-190	-427	2.6	26	11.4	26	582	1,308

TABLE 2

DESCRIPTION OF ACID MINE DRAINAGE DISCHARGES

SAMPLE DESIGNATION	ORIGIN	TYPE OF DISCHARGE
PR-5	Strip Mine	Water filled depression intermittently overflows into Pinkerton's Run
PR-6	Strip Mine	Water filled depression intermittently overflows into Pinkerton's Run
PR-9	Deep Mine	Seepage along outcrop.
PR-11	Deep Mine	Gravity drain.
PR-13	Deep Mine	Flow from collapsed mine entry.
PR-21	Deep Mine	Discharge filtering through regraded strip mine spoils.
PR-26 & PR-27	Deep Mine	Discharge filtering through regraded strip mine spoils.
4668	Deep Mine	Discharge from outcrop.
4669	Deep Mine	Gravity drain.
4671	Deep Mine	Discharge filtering through regraded strip mine spoils.
4672	Deep Mine	Combination of flows from two mine entries, one backfilled, the other partially backfilled.
4673	Deep Mine	Discharge collects in strip mine pit then overflows at low point in spoils.
4676	Deep Mine	Discharge filtering through strip mine spoils.
4677	Deep Mine	Discharge filtering through strip mine spoils.
4679	Deep Mine	Discharge along outcrop.

TABLE 2
(cont'd)

SAMPLE DESIGNATION	ORIGIN	TYPE OF DISCHARGE
4680	Deep Mine	Gravity drain.
4681	Deep Mine	Gravity drain conveyed under home development.
4682	Deep Mine	Gravity drain conveyed under home development.
4683	Deep Mine	Discharge emerging from collapsed room into strip mine pit, flows through low point in spoils.
4685	Deep Mine	Discharge emerges along outcrop.
4688	Deep Mine	Discharge emerging at base of strip mine spoils.

prefix SR and their locations shown on the Inventory Map in the inside rear pocket. Table 3 shows average sample data for the stream monitoring stations.

A map summarizing mine drainage pollution throughout the study area is shown on Figure 10. This map is based upon sample data for pH and net alkalinity and delineates those stream reaches which are continually affected by AMD from those which are intermittently affected by AMD. Any stream in the latter category is expected to be affected by extremes in precipitation and stream flow. For example, the stream reaches upstream of monitoring Stations SR-5 and SR-14 are acidic in times of mean or low flow. However, during high flow periods, such as those encountered during sample collection, the streams will contain enough unpolluted runoff to yield an alkaline water sample. Presented below is a discussion of mine drainage pollution problems throughout the study area.

The stream lying east of Pinkerton's Run and monitored by SR-6 was continuously affected by acid mine drainage downstream from SR-17, which contributed 381 lbs/day of acidity. As measured at SR-6, this stream discharged an average of 103 lbs/day of acidity into Robinson Run. Above the confluence of SR-17 with the main stream and below the junction of streams monitored by SR-5 and SR-16, the water was determined to be intermittently affected by acid mine drainage by using the general mass equation. Results of water analysis of the tributary monitored by SR-16 indicated that small seepage flows (less than 5 gpm) which were not routinely sampled, did not adversely affect water quality at this stream station. Water at SR-16 contributed an average of 108 lbs/day of net alkalinity downstream. The tributary monitored by SR-5 was determined to be intermittently affected by acid mine drainage from PR-26 and PR-27 which contributed 84 lbs/day and 70 lbs/day of net acidity respectively, in addition to 5 small AMD seepages with flows less than 5 gpm.

The downstream portion of Pinkerton's Run was continuously affected by acid mine drainage and contributed an average net acidity load of 941 lbs/day to Robinson Run, as determined at Station SR-2. Water samples taken at SR-10 revealed an average net acidity load of 653 lbs/day. Average net acidities of 466 lbs/day at SR-8 and 271 lbs/day at SR-7 continuously affected the water quality downstream to SR-10. Above SR-11 one sampled mine drainage source, PR-21, contributed 27 lbs/day of acidity to the main stream. However, reaches upstream and downstream from the junction of PR-21 were considered to be continuously affected by acid mine drainage from the upstream tributaries monitored by stream stations SR-13, SR-14 and SR-15. Lintons Run was monitored at SR-13 and was shown to be continuously affected by acid mine drainage. Upstream of SR-13 on Lintons Run, station SR-23 reveals more severe conditions, indicating some dilution as the flow progressed downstream. The acid mine drainage discharges above SR-23 originate as seepage from a reclaimed strip mine which was backfilled over deep mine drainage which currently filters through the regraded spoils and seeps into Lintons Run over a wide area.

TABLE 3

LABORATORY ANALYSIS AND MATERIAL LOAD SUMMARY STREAM MONITORING STATION AVERAGES

Stream Station	Flow (gpm)	Lab pH	Net Alkalinity * (mg/1)	(lbs/day)	Iron (mg/1)	(lbs/day)	Aluminum (mg/1)	(lbs/day)	Sulfate (mg/1)	(lbs/day)
SR-1	106	4.1	-55	- 70	0.9	1	5.2	7	330	420
SR-2	2,241	4.3	-35	-941	2.9	77	6.8	183	427	11,499
SR-3	516	4.6	-34	-209	2.9	18	5.3	33	268	1,659
SR-4	449	2.4	-269	-1,452	10.4	56	23.3	126	602	3,248
SR-5	161	5.5	18	34	1.1	2	4.2	8	490	948
SR-6	563	4.1	- 15	-103	2.8	19	5.5	37	326	2,201
SR-7	125	3.6	-181	-271	9.2	14	15.4	23	801	1,199
SR-8	231	3.1	-168	-466	5.0	14	17.4	48	582	1,613
SR-9	157	4.5	32	60	1.1	2	3.1	6	244	461
SR-10	306	3.8	-178	-653	5.0	18	14.7	54	539	1,982
SR-11	1,141	4.4	- 30	-405	2.5	34	4.7	65	453	6,213
SR-12	1,111	4.0	-106	-1,406	5.5	73	9.1	122	423	5,649
SR-13	251	4.7	- 54	- 163	1.9	6	6.4	19	631	1,901
SR-14	431	4.6	- 34	- 176	5.2	27	7.4	38	458	2,374
SR-15	210	4.5	- 35	- 88	2.6	7	7.4	19	494	1,247
SR-16	153	6.4	98	180	1.7	3	0.7	1	126	231

*Net Alkalinity = Total Alkalinity - Total Acidity

TABLE 3
(cont'd)
LABORATORY ANALYSIS AND MATERIAL LOAD SUMMARY
STREAM MONITORING STATION AVERAGES

Stream Station	Flow (gpm)	Lab pH	Net Alkalinity (mg/1)	Net Alkalinity (lbs/day)	Iron (mg/1)	Iron (lbs/day)	Aluminum (mg/1)	Aluminum (lbs/day)	Sulfate (mg/1)	Sulfate (lbs/day)
SR-17	112	2.6	-283	-381	8.3	11	23.0	31	593	798
SR-19	61	2.7	-327	-240	13.8	10	26.2	19	697	511
SR-20	43	5.6	9	5	0.6	0	4.5	2	613	318
SR-21	46	6.0	52	29	1.2	1	3.7	2	530	291
SR-23	180	4.0	-173	-374	2.1	4	12.2	26	704	1,520
SR-25	36	5.9	31	13	3.8	2	7.9	3	552	239
SR-26	111	3.1	-145	-192	20.0	27	17.3	23	502	668
SR-28	153	3.8	-113	-207	6.0	11	12.3	23	453	834

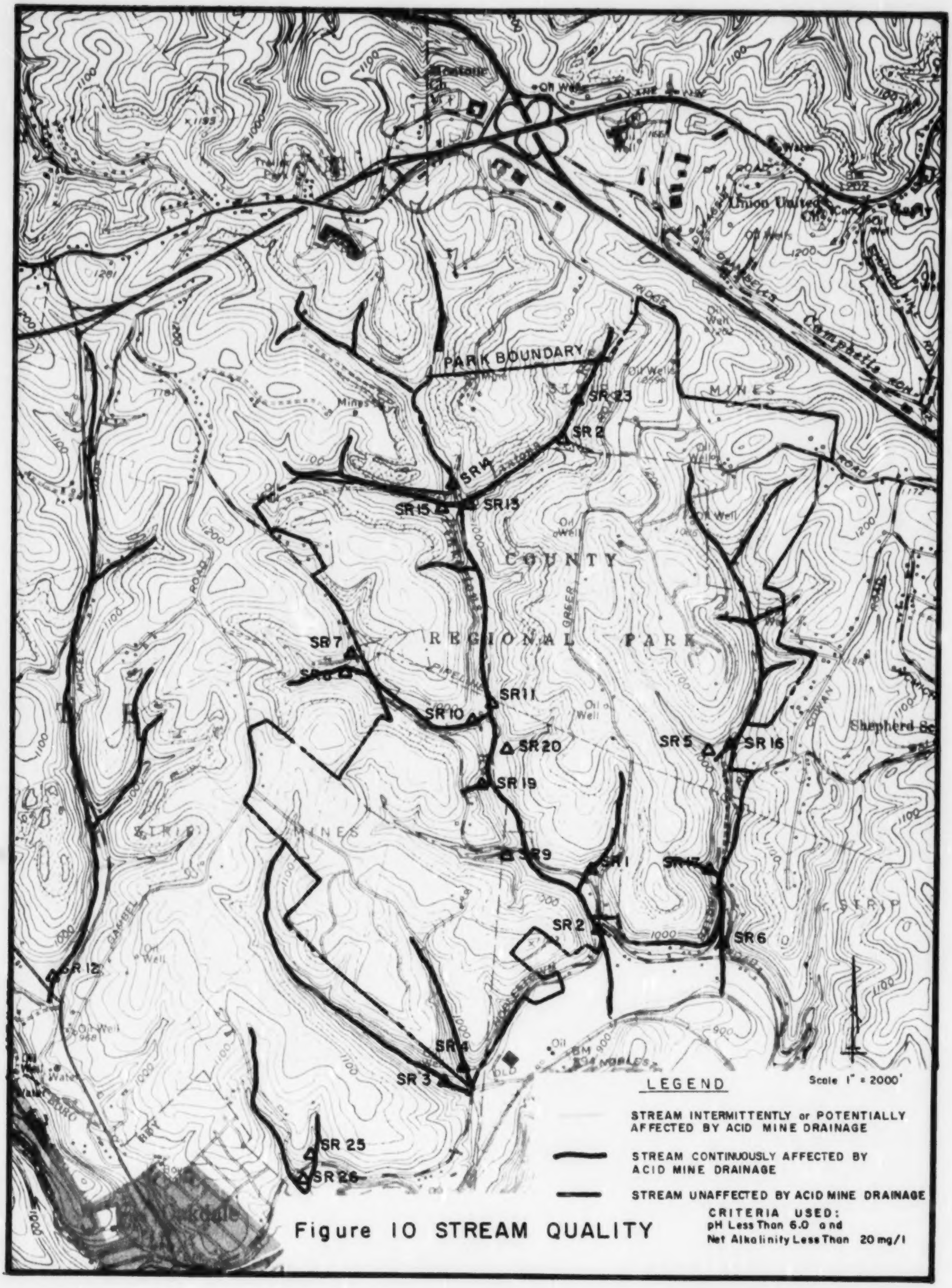

PARK BOUNDARY
MINES
STRIP
MINES
COUNTY
REGIONAL PARK
PIPELINE
ROAD
Oil Well
Union United
Shepherd Sc
Campbells
SR 23
SR 2
SR 14
SR 15
SR 13
SR 7
SR 8
SR 11
SR 10
SR 20
SR 19
SR 5
SR 16
SR 9
SR 1
SR 17
SR 2
SR 6
SR 12
SR 4
SR 3
SR 25
SR 26
Oakdale
LEGEND
Scale 1" = 2000'
STREAM INTERMITTENTLY or POTENTIALLY AFFECTED BY ACID MINE DRAINAGE
STREAM CONTINUOUSLY AFFECTED BY ACID MINE DRAINAGE
STREAM UNAFFECTED BY ACID MINE DRAINAGE
CRITERIA USED:
pH Less Than 6.0 and
Net Alkalinity Less Than 20 mg/l

Figure 10 STREAM QUALITY

Upstream from SR-14 were 4 deep mine discharges, 2 strip mine sources, and 6 small seepages (flow less than 5 gpm). Sources PR-6 and PR-5 discharged from water filled strip mine depressions and were capable of flushing high quantities of acid into Pinkerton's Run following a storm.

The stream lying southwest of SR-2 and monitored by SR-4 was considered from water quality data to be the most seriously degraded stream in the study area. Water monitored at SR-4 had an average pH of 2.4 and discharged an average net acidity load of 1,452 lbs/day into Robinson Run. This stream received an average of 855 lbs/day net acidity from AMD source 4675, the largest acid producing source on the study area. An additional 105 lbs/day average net acidity was contributed by source 4673. The stream reach monitored by SR-3 contained two point sources, 4676 and 4677 which caused the stream to be continuously degraded by acid mine drainage. An average net acidity load of 209 lbs/day, as measured at SR-3, was discharged into Robinson Run from this area.

The stream monitored by SR-26 was found to be continually polluted by point sources 4679 and 4680. These two sources contributed an average net acidity load of 331 lbs/day. PR-1 contributed water of higher quality to the stream but provided little improvement in overall water quality as indicated by an average net acidity load of 192 lbs/day and an average pH of 3.1 at SR-26.

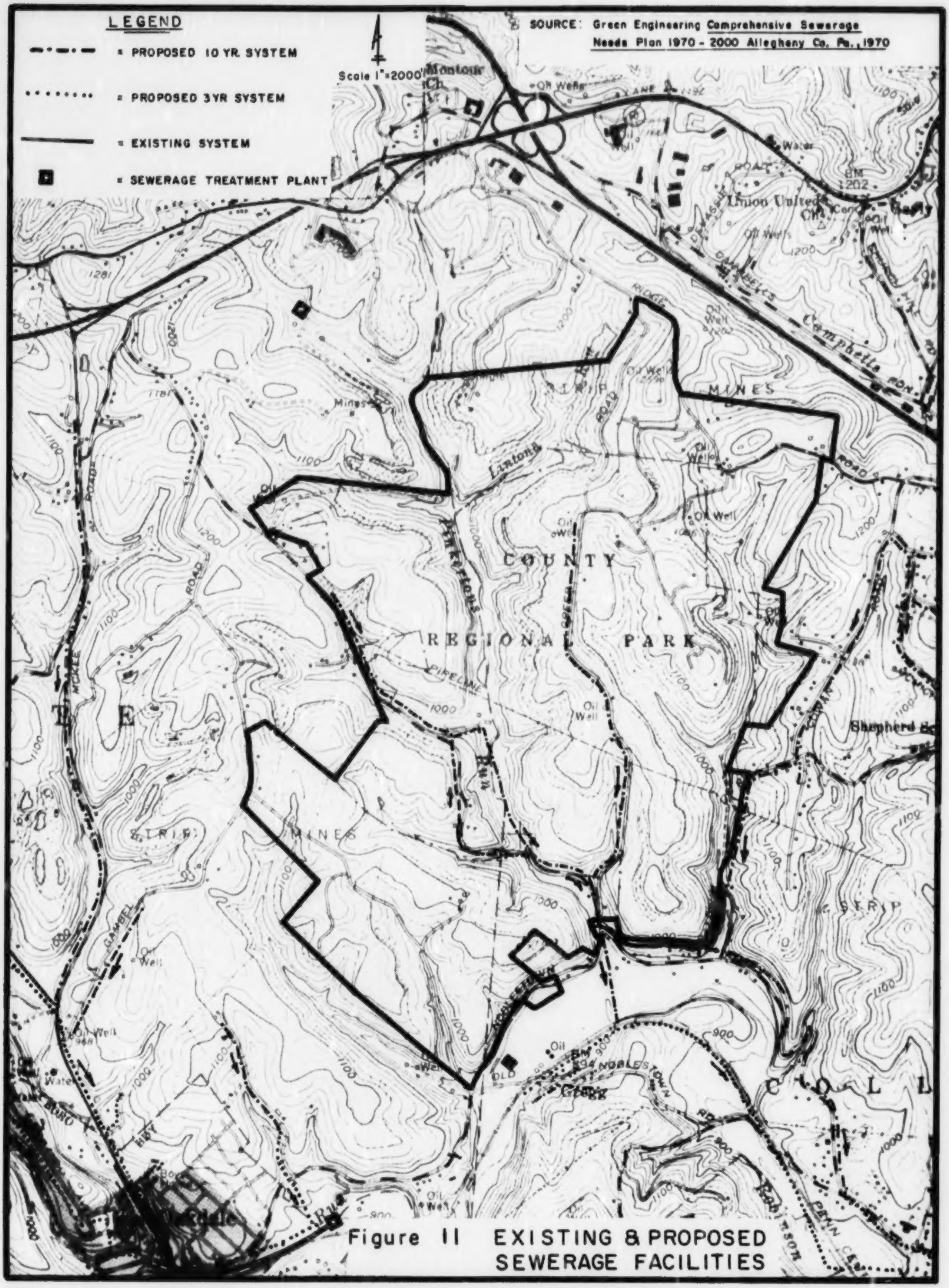
The stream flowing along the west side of McKee Road, monitored by SR-12, was considered continuously affected by acid mine drainage. Three deep mine drainage discharges, 4683, 4685 and 4688, were found to be responsible for a total of 763 lbs/day of acid, yet at monitoring Station SR-12, 1,406 lbs/day of acid were being discharged into the North Branch of Robinson Run, indicating that about half of the acid load at SR-12 were derived from pollution sources located beyond the study area.

FRESH WATER SUPPLIES AND WASTE WATER

Water Supply: The project and adjacent areas are serviced by two public water supply systems. A service line belonging to the Western Allegheny County Municipal Water Authority runs along Pinkertons Run Road, while the eastern portion of Settler's Cabin Park is serviced by the Robinson Township Municipal Water Authority. Most of the private residences within the Pinkerton's Run Watershed, however, have private water supplies such as wells or cisterns. These individual domestic water supplies are relatively reliable because their source of water lies below the Pittsburgh coal seam and is probably unaffected by coal mining operations.

The existing public water supply systems should be adequate to serve the needs of the watershed, including Settler's Cabin Park. However, individual water wells may be desirable as a water supply. If wells are chosen as a source of water, they should be drilled to the aquifer lying below the Pittsburgh coal seam. Aquifers occurring immediately above the mined coal seam have questionable permeability because of dewatering due to subsidence fractures.

Sewage: Public sewage disposal systems do not service the project area. The homes in the area utilize individual septic tanks. The soils at these locations appear to be adequate to support septic tank systems since few problems are known to exist. Rest room facilities in Settler's Cabin Park currently use concrete pits which are pumped out each year. One private sewage treatment facility is located near the headwaters of Pinkerton's Run and services Parkway West Technical School. The system serves approximately 2,250 users and treats sewage completely, as defined in the permit application. Sanitary sewage pollution does not appear to be a problem within the area at the present time. Presently, septic tank systems appear to be adequate for disposal of domestic sewage. Sewage disposal problems in Settler's Cabin Park and surrounding areas will become greater as the park attracts more visitors. Consideration should be given to future modification of existing sewage treatment facilities so that a further deterioration of water quality and potential health hazards are avoided. Figure 11 illustrates the existing and proposed sewage facilities for the project area.


LEGEND
= PROPOSED 10 YR SYSTEM
= PROPOSED 3 YR SYSTEM
= EXISTING SYSTEM
= SEWERAGE TREATMENT PLANT
Scale 1"=2000'
Montour Ch.
Oil Wells
Union United Ch.
Campbells Run
Dunbars
RIDGE
Oil Well
STRIP
MINES
Lintona ROAD
Mines
COUNTY
REGIONAL PARK
PIPELINE
McKEE ROAD
Shepherd
STRIP
MINES
GAMBEL
NOBLESTOWN
Gregg
OLD
NOBLESTOWN RD
COLL
Robinson
PENN
Water
Oil Well
Run

SOURCE: Green Engineering Comprehensive Sewerage Needs Plan 1970 - 2000 Allegheny Co. Pa., 1970

Figure 11 EXISTING & PROPOSED SEWERAGE FACILITIES

CHAPTER 4

FORMULATING A PLAN

OBJECTIVES

The initial step in formulating the abatement plan was the determination of minimum objectives. These objectives were designed specifically to achieve a solution to environmental problems inherent in the Settler's Cabin Park and Pinkerton's Run study area. Standards of pollution abatement, water use, and the application of mined land reclamation techniques were considered in the determination of minimum objectives.

Three categories of objectives were formulated to serve as guidelines for the formulation and evaluation of a mine drainage pollution abatement plan. The three categories were:

1. Technical Objectives: Provide sufficient water pollution abatement measures to insure an aquatic habitat capable of supporting aquatic life.
2. Economic Objectives: Provide a minimum cost, technically acceptable plan.
3. Aesthetic and Recreational Objectives: Within Settler's Cabin Park achieve a reclamation plan which conforms with land use objectives and which minimizes adverse impact upon the terrestrial habitat.

These three general guidelines were then amplified into more detailed criteria for quantifying and evaluating alternative reclamation plans and effects.

CRITERIA

TECHNICAL CRITERIA

The technical criteria for achieving clean water was based upon the Commonwealth of Pennsylvania's Water Quality Criteria Guidelines according to Chapter 93 of Title 25 (Department of Environmental Resources, Rules and Regulations).

The study is included in the Robinson Run Basin and the applicable chemical water quality criteria are:

pH	Not less than 6.0, not more than 8.5
Dissolved Oxygen	For the period 2/15 to 7/31 of any year, no value less than 5.0 mg/1. For the remainder of the year, no value less than 4.0 mg/1
Iron	Total iron not more than 1.5 mg/1

Temperature	Not more than a 5 degree Fahrenheit rise above natural temperatures or a maximum of 87 degrees Fahrenheit, whichever is less.
Dissolved Solids	Not more than 500 mg/l as a monthly average value, not more than 750 mg/l at any one time.

The pH value of 6.0 was chosen as the target value for the criteria. A regression curve defining the value of the pH based upon net alkalinity (net alkalinity throughout this report refers to total alkalinity minus total acidity) values was determined. This curve showed a pH of 6.0 corresponded to a net alkalinity concentration of 30 mg/l based upon randomly selected baseline data.

However, streams polluted by acid mine drainage can be most critically degraded during low flow periods. This phenomenon usually results during the low precipitation periods of June through August in western Pennsylvania. During this time, the sole constituents of streams may be ground water and mine discharges. The streams would, therefore, exhibit a depressed pH with high acidity and iron values due to the lack of unpolluted, usually alkaline runoff.

Because no water quality monitoring occurred for this study during the usual low flow period, no direct explanation of water quality as a function of seasonal variation in flows could be derived. However, the basis for designing an abatement plan using seasonal low flow criteria is supported by two factors. First, water quality data for Chartiers Creek and its largest tributaries exhibited the poorest water quality at the time of the minimum measured discharge. This data was compiled over a hydrologic year and was collected as a component of the Chartiers Creek mine drainage survey. (1) Secondly, every stream monitoring station in the Settler's Cabin Park study area that received mine effluent showed a positive correlation between flow and net alkalinity (although not all correlations were statistically significant) thus indicating that net alkalinity increased as stream flow increased.

Recognizing that low flow periods would be the most crucial, a design low flow was selected. The design low flow chosen was the seven day consecutive low flowing period occurring once in ten years. Discharge records were obtained from the U. S. Geological Survey for the stream flow gage on Chartiers Creek at Carnegie, Pennsylvania. The ten year, seven day low flow for various stream stations within the watershed were determined by linear regression and proportion based on the discharge records at the Chartiers Creek gage. The design low flows for selected stream monitoring stations throughout the watershed are shown on Table 4. Also included in Table 4 are the mean flows, ten year-seven day high flows, and the average sample data flows obtained during the sample collection phase of the project.

The design criteria for evaluating and selecting an AMD abatement plan was determined as the achievement of a net alkalinity concentration of 30 mg/l at each stream monitoring station under the low flow conditions. However, it must be recognized that since all samples and flow measurements

TABLE 4

FLOW CONDITIONS* FOR SELECTED LOCATIONS WITHIN THE SETTLER'S CABIN PARK STUDY AREA

Stream Station	Sampled Mean Flow	High Flow[1]	Mean Flow[2]	Low Flow[3]
SR-2	2241	4560	1194	550
SR-3	516	1050	275	127
SR-4	449	914	240	110
SR-5	161	327	86	40
SR-6	563	1146	300	138
SR-7	125	254	66	31
SR-8	231	470	123	57
SR-9	157	319	84	39
SR-10	306	623	163	75
SR-11	1141	2322	608	280
SR-12	1111	2261	592	273
SR-13	251	511	134	62
SR-14	431	877	230	106
SR-15	210	427	112	52
SR-16	153	311	82	38
SR-17	112	228	60	27
SR-19	61	124	33	15
SR-20	43	87	23	11
SR-21	46	94	24	11
SR-23	180	366	96	44
SR-25	36	73	19	9
SR-26	111	226	59	27

[1] High Flow = 10 year, 7 day high flow
[2] Mean Flow = Mean daily flow exceeded 50% of the time
[3] Low Flow = 10 year, 7 day low flow
* All flows in gallons per minute

were obtained in the wet weather period, (December through February), low flow characteristics could not be derived from a mathematical model within acceptable confidence limits. This model has the limitation of having no actual low flow water quality characteristics.

ECONOMIC CRITERIA

Abatement plans which fulfilled the technical criteria were subjected to cost analysis. All abatement plans were designed for an economic life of 20 years. This was done to prevent an irretrievable commitment of resources which may preclude a more cost effective and efficient method from being applied after 20 years. All first time costs were amortized at 7% per year to yield an equivalent annual cost (capital recovery factor). Any operation and maintenance costs were estimated as an annual value and added to the equivalent annual costs. Finally, all projects which were judged to be technically feasible (fulfill the technical criteria) were evaluated based upon the lowest equivalent annual costs.

AESTHETIC AND RECREATIONAL CRITERIA

Because aesthetic and recreational criteria were difficult to quantify, only general guidelines were formulated. The landscape architect's (9) conception of park development was incorporated into plans for reclamation projects. Three general areas were proposed by the architect for land use within the park. The three categories were picnic areas, reforestation areas, and game refuge areas. Thus, all abatement plans not only considered one or more of these three land use areas, but all land reclamation plans included a specific reclamation and revegetation scheme for the proposed land use.

Because the aesthetics of the park were an important consideration, general guidelines for all alternative plans were developed. These general guidelines include the elimination of scarred landscape, improving the terrestrial habitat for wildlife, and minimizing, where possible, any adverse impacts upon the environment, such as the construction of equipment access roads and unsightly abatement facilities.

Finally, the landscape architect's plans for three fishing areas were modified to provide for an interim objective of developing at least one fishing area suitable for stocking game fish. That area would be the single location best satisfying other fish habitat characteristics, such as temperature, dissolved oxygen, potential for food supply, and acceptable chemical water quality.

ALTERNATIVES

ABATEMENT METHODS

Mine drainage in the Settler's Cabin Park study area is a problem deriving from abandoned deep mines. Ninety-five percent of the documented acid load was attributed to deep mines. Whereas only one strip mine contributed five percent of the acid load, and because conventional strip mine reclamation is both straightforward and usually technically successful, several appropriate abatement measures for deep mine drainage were formulated. The measures which were considered include:

1. Inundate Deep Mine Workings: By placement of hydraulic seals with impervious material along the outcrop, the atmospheric oxidation of pyrite should be eliminated.

2. Restore Strip Mines: Several strip mines were located updip of adjacent deep mines within the study area. Some of these strip mines were unreclaimed or poorly reclaimed to the extent that they trapped natural runoff in depressions. This trapped runoff may infiltrate to the adjacent deep mine workings to be discharged by gravity as deep mine drainage.

3. Restore Subsidence Areas: In at least one case, surface subsidence over shallow cover disrupted normal surface runoff patterns and allowed direct entry through sinkholes into an abandoned deep mine. Moreover, the extensive subsidence areas within Settler's Cabin Park restrict conventional development of the site for picnic areas or ballfields.

4. Construct Barriers in Deep Mine Workings: This would require excavation or box cuts across abandoned workings and backfilling with select impervious material to implement a series of small inundated sections of the mine. The theory of this method is the same as No. 1, i.e., to prevent pyrite from contacting atmospheric oxygen.

5. Solid Waste Injection: The disposal of fly ash in an abandoned mine is a proven method of subsidence control. Injected into the mines beneath Settler's Cabin Park, it would not only reduce the risk of subsidence, but would create small isolated sections of the mine that are partitioned by a highly alkaline and supportive solid waste.

6. Lower the Ground Water Table: This method would attempt to dewater the aquifers above the Pittsburgh coal that are currently draining into the abandoned mine workings. It would require a series of connector wells to dewater the source bed above the Pittsburgh coal and convey the water through the abandoned mine workings into a lower aquifer.

7. Treatment Measures: Methods considered were aeration and oxidation, chemical neutralization and demineralization.

8. Daylighting: Daylighting is defined as removing all portions of the remaining coal reserves in an abandoned deep mine. The overburden is excavated, most of the coal and acid-forming materials removed, and the overburden is replaced, regraded and revegetated.

9. Diversion: This includes intercepting localized mine discharges and conveying the AMD to either a treatment plan or to a stream that is able to assimulate the acid.

SCREENING OF ABATEMENT ALTERNATIVES

The original abatement considerations were then screened based upon a combination of technical feasibility, economics, problems indigenous to the study area, and adverse impact upon the ecosystems. The reasons for elimination are discussed below.

Mine sealing or methods to inundate mine workings to prevent pyrite oxidation is usually unsuccessful and even dangerous where a hydraulic head is expected. (5) Within the study area, most outcrops have been strip mined and left with partially exposed highwalls having numerous collapsed and abandoned room and drift entries. This strip mining, plus the severe fracturing anticipated for the overburden above the mine workings (as indicated by abundant subsidence depressions) indicates that Settler's Cabin Park is a poor site to attempt this abatement method. To insure inundation, even during the low ground water period, would require a pressure injected grout curtain along the coal outcrops. Considering the north-south trend of the mine workings and the general dip of the coal to the south, this necessary grout curtain has conservatively been estimated to cost ten million dollars.

The injection of fly ash into the abandoned mine workings was eliminated from further consideration for two reasons. First, fly ash injection, while expected to be technically feasible, was considered to have a prohibitive cost because of the large material quantities required to adequately fill the mine workings. Secondly, fly ash injection requires drilling injection holes at relatively close intervals (50 ft. center to center), thus creating a grid of equipment access roads that would seriously harm both the existing aesthetic qualities of the park and the wildlife habitat.

Lowering the ground water table was ruled out based upon the subsurface drainage patterns of the rock strata normally subjected to severe fracturing following mining of the Pittsburgh coal seam. The ground water flow in the source bed above the Pittsburgh coal was assumed to have insufficient lateral movement to make an aquifer drawdown system feasible.

CHAPTER 5

RECOMMENDATIONS

From the process of screening abatement plan alternatives, as discussed in Chapter 4, a recommended abatement plan was developed. This chapter summarizes that plan and includes a preliminary scope of work with cost estimates.

THE SELECTED PLAN

A comprehensive mine drainage abatement plan was devised for Settler's Cabin Park which includes five steps or phases for implementation. The first phase, or Phase I, should, by itself, be sufficient to fulfill the technical criteria of achieving an inflow of 30 mg/l of net alkalinity concentration at each stream monitoring station in the Pinkerton's Run Watershed during the once in ten year, seven day consecutive low flow. The plans are numbered Phase I through Phase V with each phase being successively more complex.

Certain individual abatement methods are common to all five phases. These common methods were judged to be the minimum requirements necessary to achieve the project objectives in all five phases.

The first and most important abatement method common to the five phases is the reclamation of the strip mine formally designated OAK 30 in the Chartiers Creek report (1) and hereinafter designated Work Area No. 1. The location of Work Area No. 1 and all subsequent plans are found on the Abatement Plan drawing in the inside rear pocket. Abatement procedures recommended in the Chartiers Creek report for Work Area No. 1 were interpreted to produce an estimated flow reduction of 25 percent at 4688 by decreasing infiltration into the abandoned deep mine complex interconnecting OAK 30 and source 4688. The design of the project was authorized by the Department of Environmental Resources as Project SL 102-7-20. Plans, drawings, and a cost estimate were completed for this site, although the design was never finalized by the Department of Environmental Resources. Reclamation of strip mine OAK 30 was halted when the property owner, Patrick J. Fleck, doing business as Deep Valley Coal Company, obtained a mine drainage permit, 3474SM15, for an area covering OAK 30. As of this writing, a strip mine permit has been applied for but has not been granted for OAK 30.

Two mine drainage discharges, PR-5 and PR-6, were attributed to Work Area No. 1. Since the two discharges result only during or after a storm when water filled depressions overflow, sources PR-5 and PR-6 have the capacity to degrade Pinkerton's Run with a slug of acidic water.

The second abatement method found in all five alternatives is an interceptor system designed to collect localized deep mine discharges and bypass the streams and eventually discharge the collected AMD into Robinson Run, either treated or untreated, depending upon the selected plan.

ABATEMENT PLAN SUMMARY

Following are summaries of the five phases. The location of all recommended work areas is shown by phases on the Abatement Plan drawing in the inside rear pocket, and an impact summary of all phases is shown on Table 5. A "no-action" alternative is also summarized for baseline establishment.

No Action: Except for the stream reach upstream of monitoring station SR-16 and three small tributaries, water quality in all streams of the study area exhibits depressed conditions; pH ranges from 2.0 to 6.5, net acidity concentrations range from 0 mg/1 to 300 mg/1, and total iron concentrations of 0.9 mg/1 to 20.0 mg/1. Based upon two water samples and analysis, the pH and acidity of Robinson Run improved after mixing with the waters of Pinkerton's Run. The streams affected by AMD are virtually devoid of aquatic life due to high acidity, ferric hydroxide, and aluminum hydroxide pollution.

The tributary monitored by SR-16 has the least objectionable mine drainage pollutants and may currently support aquatic life. This stream appears to be the most suitable game fishing development area. However, two requirements must be met to provide a viable game fish population. First, the aquatic habitat must be acceptable for macroinvertebrates, and, secondly, the stream would probably require impounding to provide enough area for game fish.

Prominent scarring of the landscape has occurred from contour strip mining which poses limitations upon the aesthetic appreciation of the environment. Finally, the unreclaimed strip mines, with their exposed highwalls and sparsely vegetated areas, coupled with an extensive mine subsidence problem, present a limitation in land use development and the planning of recreational facilities.

Phase I: Phase I calls for the reclamation of the unreclaimed strip mine designated as Work Area No. 1, and the installation of a mine drainage interceptor system for Pinkerton's Run. This plan should achieve a pH of 6.0, a net alkalinity of 30 mg/1 under low flow conditions from monitoring station SR-14 to the confluence of Pinkerton's Run and Robinson Run, plus improve the largest tributaries of the watershed. Chemical water quality of Robinson Run will be unaffected and a slight increase in ferric hydroxide will result upon mixing the residual alkaline stream flow with AMD just before discharging into Robinson Run. However, due to the degraded condition existing in Robinson Run (1), this additional yellowboy deposit will probably be harmless unless AMD problems in Robinson Run are abated. Following Phase I reclamation, the water quality in Pinkerton's Run should improve sufficiently to allow the re-establishment of aquatic life if no other pollutants exist. Estimated residual chemical water quality characteristics are shown on Table 6.

TABLE 5

IMPACT SUMMARY OF ABATEMENT PLAN BY PHASES

	Water Quality	Ecology	Aesthetics	Recreation
No Action	Waters will remain polluted by AMD and will have little recreational value	Abandoned strip mines will prohibit vegetation, continued depressed aquatic habitat	Unsitely strip mines and deep mine refuse areas will persist	Restricted by strip mines, poor vegetation and subsidence areas
Phase I	Improve water quality of Pinkerton's Run and unnamed tributary monitored by SR-6	Improve the aquatic ecology conditions of Pinkerton's Run and 3 major tributaries	Aesthetic improvement of Work Area 1, no improvement of park land aesthetics	Stream improvement will encourage the development of recreational facilities along Pinkertons Run
Phase II	Improves water quality by reducing infiltration to deep mine	Improves aquatic and terrestrial habitat within the park	Increase aesthetic value of park	Returns 8 acres to productive recreational land
Phase III	Improves water quality by reducing siltation	Improves the terrestrial habitat and facilitates park planning	Increases aesthetic value of park	Returns an additional 77 acres to productive recreational land
Phase IV	Restores tributary at SR-17	Improves the terrestrial and aquatic habitat, enables picnic area development	Increases aesthetic value of park	Returns an additional 34 acres to productive recreational land
Phase V	Improves the water quality of additional streams beyond the park boundary	Improves the aquatic ecology at streams beyond park boundary	Reduction of chemical precipitates in Robinson Run	Allows greater public utilization of streams

TABLE 6

ESTIMATED WATER QUALITY FOLLOWING THE IMPLEMENTATION OF PHASE I

Monitoring Station	Existing Water Quality*					Estimated Water Quality After Phase I				
	Flow (gpm)	pH	Net Alkalinity (mg/1)	Total Iron (mg/1)	Total Aluminum (mg/1)	Flow (gpm)	pH	Net Alkalinity (mg/1)	Total Iron (mg/1)	Total Aluminum (mg/1)
SR-2	2241	3.6	-35	2.9	6.8	1490	6.1	61	2.3	1.5
SR-7	125	3.6	-181	9.2	15.4	40	6.4	218	0.0	0.0
SR-8	231	3.1	-168	5.0	17.4	90	6.1	59	0.0	5.6
SR-11	1141	4.4	-30	2.5	4.7	790	6.0	46	0.0	0.0
SR-13	251	4.7	-55	1.9	6.4	70	6.5	247	2.3	0.0
SR-14	431	4.6	-34	5.2	7.4	260	6.3	147	0.0	0.0
SR-15	210	4.5	-35	2.7	7.5	210	4.5	-35	2.7	7.5

*Based upon sample data, estimated water quality is based upon similar flow condition as the sample data

Phase II: Phase II adds to Phase I surface reclamation areas which will reduce infiltration to the deep mine complex, augment the flow of Pinkerton's Run by promoting positive drainage and reduce strip mine erosion. Five additional surface reclamation work areas totaling 18 acres are specified. The five additional work areas are designated Work Areas 2, 5, 7, 8 and 10. A total of 18 acres are to be reclaimed under Phase II. Of these 18 acres, 12 acres lie within the park boundary while 8 acres lie within proposed park use areas. By restoring the 18 acres to positive drainage, approximately 63 acres will contribute augmented runoff to the study area streams. This will amount to an average 56,000 gal. per day of clean water during a year of average precipitation. A moderate improvement in the aquatic ecology is expected over Phase I due to increased stream flow and improved aquatic habitat during high and average flow periods. Aesthetic and recreational benefits will be enhanced by the reclamation of Area 5, if Phase II development for Settler's Cabin Park is implemented.

Phase III: Phase III adds four work sites for which revegetation is planned. The benefits of the revegetated areas will be measured by decreased erosion and sediment pollution, aesthetic enhancement and the facilitation of beneficial land use. The four work areas chosen for Phase III are Areas 3, 4, 6, and 11, totaling 77 acres. Work Area No. 4 lies on the periphery of the existing recreation facilities, while Work Areas 3, 6 and 11 all coincide with proposed park development.

Phase IV: This plan modifies Phase III to include two daylight areas designated Work Area Nos. 9 and 12. Improvements in water quality are expected to be a minor result of Work Area 9 which currently is disrupting normal drainage patterns of the headwaters of the unnamed tributary monitored by station SR-4. However, the daylighting of Work Area No. 12 should result in the elimination of approximately 380 lbs. per day of acid currently being discharged into the unnamed tributary monitored by SR-17. The potential for aquatic life will improve below the confluence of the tributaries at monitoring stations SR-5 and SR-16. Work Area No. 12 coincides with a proposed picnic area. Daylighting not only results in the clearing of vegetation, the regrading and planting necessary for developing a picnic area, but is the surest way to eliminate the many sinkholes existing on the site and to remove the risk of mine subsidence once the area is developed.

Phase V: The last phase of the recommended abatement plan is a plan for the comprehensive removal of all mine drainage that degrades the streams of the project area. In addition to Phase IV, Phase V collects localized AMD discharges from two unnamed tributaries, monitored by SR-3 and SR-4 and all additional localized AMD discharges located along the west and southwest of the project area. To promote a regional mine drainage abatement plan for Robinson Run and Chartiers Creek, Phase V includes a lime neutralization treatment facility located in the flood plain of Robinson Run.

PLAN DESCRIPTION

The recommended sequence of implementation for the abatement begins with Phase I and proceeds with a comprehensive plan for the project area, culminating with Phase V. This section describes the recommended scope of work and summarizes the estimated costs.

PHASE I

Phase I includes the reclamation of one strip mine designated as Work Area 1 (see the Abatement Plan in the inside rear cover pocket for all abatement plan locations) and for the installation of an interceptor system designed to intercept 10 AMD discharges and bypass Pinkerton's Run. Work Area 1 is owned by Patrick J. Fleck. The area is currently under a mine drainage permit but is not covered by a strip mining permit. In the event an application for a strip mining permit is made, consideration should be given to a special reclamation project which would combine mined land reclamation with strip mining. The jurisdictional framework for the type of work exists within the Commonwealth of Pennsylvania.

Scope of Work: Regrade 26 acres of Work Area 1 to provide positive drainage, drain and treat existing water-filled depressions, close two mine openings. Construct 2,200 lin. ft. of diversion ditch at the top of the existing highwall, and install 290 lin. ft. of bituminous flume across the required bench to minimize infiltration into the spoils.

Install 23,000 lin. ft. of plastic pipe from 10 AMD discharges. Install concrete catch basins at 9 discharges and excavate a trench through the toe of the reclaimed strip mine upstream of SR-23 to place a perforated pipe to collect AMD seepage. Install a total of 78 manholes, one at every pipe confluence and at every 300 lin. ft. along each interceptor. The pipe is to be installed at a minimum of 4 ft. below the ground surface and should parallel the streams along the floodplain.

Estimated Costs: Initial costs for the surface reclamation are estimated at $109,000 for construction. Because this project has been designed under DER Project SL 102-7-15, no engineering costs were included. No operation and maintenance costs were estimated for this project, nor for any surface reclamation projects.

The estimated cost for the interceptor system is $217,000, installed. This price includes clearing and grubbing, excavation, pipe installation, backfilling, seeding, manholes and catch basins. Annual inspection and maintenance costs were estimated at $11,000.

PHASE II

Phase II adds the restoration of five portions of unreclaimed strip mines. All five areas currently contain depressions which restrict natural surface drainage and allow infiltration from water-filled depressions into adjacent abandoned deep mines. The work areas are designated 2, 5, 7, 8 and 10 on the Abatement Plan map in the inside rear cover pocket.

Scope of Work: Regrade a total of 18 acres in five unreclaimed strip mine areas to provide positive drainage and revegetation. Samples of the upper spoil layer should be tested for nutrients and fertilizer requirements to insure adequate soil treatment.

Estimated Costs: The restoration of Work Areas 2, 5, 7, 8 and 10 are estimated to cost $69,000 for construction. No operation and maintenance costs are anticipated.

PHASE III

Phase III consists of revegetating four strip mines with appropriate grasses, legumes, trees and shrubs. The revegetation will enhance the aesthetics of the park, facilitate development of proposed revegetation facilities, provide a buffer zone between existing and proposed high density picnic areas and unsightly strip mines, and minimize erosion.

Scope of Work: In accordance with the Preliminary Planning Report for West Park Site No. 6 (9), revegetate a total of 77 acres in Work Areas 3, 4, 6 and 11. Appropriate grasses, legumes, trees and shrubs for reforestation areas and game refuge areas, and their locations, are shown on the Abatement Plan map in the inside rear cover pocket.

Estimated Costs: The combined costs for the four areas are estimated at $42,000. Trees should be purchased from the Department of Environmental Resources, Bureau of Forestry, Division of Forest Advisory Services, Nurseries Branch.

Phase IV

Work Areas 9 and 12 are approximately 30 to 50 ft. above an abandoned deep mine. Roof collapse in the deep mines and subsequent fracturing of the rock units above the coal have caused extensive surface subsidence in each of these areas. This subsidence causes severe limitations upon land development within the park, especially Area 12 which is intended to become a picnic area. Moreover, Area 9 is promoting rapid infiltration of storm runoff through subsidence areas. This infiltration probably discharges as part of AMD source 4676 located at the headwaters of the stream monitored by station SR-3. Also, the interpretation of subsurface structure and mine drainage patterns indicates that the mine complex of Work Area 12 is responsible for the 380 lbs. per day of acid monitored at station SR-17.

Scope of Work: Daylight or excavate the deep mine workings of 3 acres of Work Area 9 and 31 acres of Work Area 12. Remove remnants of the main Pittsburgh coal plus roof and bony coals and the Pittsburgh rider coal. Approximately 6,000 and 62,000 tons of marketable coal for Work Areas 9 and 12 respectively could be recovered to offset the construction costs.

In Work Area 9 place approximately 2,700 cu. yds. of rock filter material along the working face before backfilling if additional deep mine drainage is encountered. Regrade to approximate original contour. For Work Area 12 place a clay blanket and select relatively impervious spoil material along the northern work limits prior to backfilling. Backfill and grade to finished contours for the proposed picnic area development.

Estimated Costs: First time costs only are anticipated for the two proposed daylighting costs. Estimated construction costs for Work Area 9 are $211,000 less an income of $120,000 for anticipated recoverable coal reserves, for a net estimate of $91,000. The construction of Work Area 12 is estimated at $2,012,000 less $1,240,000 for income from the sale of coal, or a net estimate of $772,000. Twenty dollars per ton of coal was used as the estimated selling price for the cost estimates. However, this price is subject to rapid change and, in 1976, may be expected to decline. Thus, the net estimated daylighting costs may be higher than originally anticipated.

PHASE V

The final phase of the recommended abatement program includes a lime neutralization treatment facility to chemically neutralize the AMD conveyed by the Phase I interceptor system and for the construction of additional interceptors from AMD discharges 4673 through 4688 located to the west and southwest of the project area.

This phase is intended as a long range goal and should be considered as a possible component of a more comprehensive appraisal of mine drainage and water resources problems throughout the Robinson Run and Chartiers Creek drainage basins.

Scope of Work: Install approximately 31,000 lin. ft. of plastic pipe to intercept at least 11 AMD discharges designated 4673 through 4688 in the west and southwest portions of the project area. The AMD sources should be conveyed by gravity to a lime neutralization treatment facility located in the flood plain of Robinson Run near the confluence with Pinkerton's Run. The treatment facility will chemically neutralize and oxidize the mine drainage such that the discharged effluent will comply with Title 25, Chapter 93, Water Quality Criteria for pH and iron.

The design flow for the treatment facility was estimated at 2,500 gal. per minute with a weighted average acidity concentration of 275 mg/1. All design parameters for the unnamed tributary to the North Branch of Robinson Run, monitored by station SR-12, were estimated due to AMD discharges beyond the scope of the current survey. Additional flow and water quality characteristics should be obtained along this stream reach for design purposes.

Estimated Costs: Installation of the interceptor system to join the Phase I system at the mouth of Pinkerton's Run was estimated to cost $326,000. Operation and maintenance of the system for its 20-year economic life was estimated at $17,000 per year. The construction cost of the treatment facility was estimated at $1,043,000 with $90,000 per year for operation and maintenance.

COST SUMMARY

Provided on Table 7 is a summary of the total estimated costs to implement each phase. Part of the capital costs include estimated engineering and design services, exclusive of surveying, aerial photography and map preparation. All costs are derived from 1976 unit prices for construction labor and materials or adjusted to 1976 based on the "Engineering News Record" 20 cities construction cost index. Finally, capital costs were amortized at 7% interest for 20 years and added to estimated operation and maintenance costs to yield an equivalent annual cost for each phase. All estimated costs have been rounded to the nearest $1,000.

TABLE 7

COST SUMMARY

Phase	Estimated First Costs Construction	Engineering	Total	Estimated Operation and Maintenance Costs per Year	Equivalent Annual Costs
I	$326,000	$17,000	$343,000	$11,000	$43,000
II	69,000	6,000	75,000	-	7,000
III	42,000	-	42,000	-	4,000
IV	863,000	63,000	926,000	-	87,000
V	1,369,000	102,000	1,471,000	107,000	246,000

ENVIRONMENTAL IMPACT ASSESSMENT

PRESENT ENVIRONMENTAL CHARACTERISTICS

Human Population Distribution: Settler's Cabin Park is situated in a rural, residential and agricultural section of Allegheny County. The population density of the area is classified at 0 to 1.5 persons per gross acre. (8) Homes are generally clustered intermittently along the network of dirt and hard surface roads which parallel the north-south trending ridges of the area. Local businesses are concentrated along Rt. 22-30 bordering the park on the north, and near the community of Oakdale approximately 1-1/2 miles southwest of the park.

Terrestrial Plant and Wildlife Conditions: The effect of past coal mining within the present park boundary is both extensive and prominent. The landscape is marked with mine dumps, decaying tipples and scarred with abandoned strip mines. Only hilltops and valley floors escaped alteration. It is possible, in a general way, to establish the chronology of the stripping operations by noting the degree of reclamation. Unregraded high walls and open pits indicate the earliest strip mining, while regraded and planted areas evidence the latest mining. For the most part, the reclaimed strip mines within the park have partially regraded sloping highwalls, gently sloping benches, and are vegetated with grasses and young trees.

The numbers and distribution of wildlife species are much more difficult to determine; however, certain inferences can be made. Although the project area cannot be classified as a natural undisturbed wildlife habitat, field observations indicate extant populations of wildlife, including deer, pheasant, grouse, rabbit, etc. Numerous browsing and nesting sites, characterized by tall grasses, fruit bearing shrubs, bushes and trees are found throughout the project area.

The Aquatic Habitat: Coal mining has had its greatest environmental impact on the streams of the area. While the land makes a slow recovery from the effects of mining, the streams continue to be poisoned by acid mine drainage. Field observations indicate that while a variety of macroinvertebrates exist in the streams, fish populations which are usually less tolerant have also been less successful. The only really "habitable" stream, based on chemical water quality, within the project area is the stream monitored by SR-16. It, however, is too small to support game size fish. In general, the aquatic habitat within the project area is severely stressed by acid mine drainage resulting in few or no extant fish populations.

DESCRIPTION AND MOTIVES FOR THE PROPOSED ABATEMENT

The proposed abatement system is composed of techniques designed to alleviate acid mine drainage and enhance the recreational potential of Settler's Cabin Park and adjacent areas.

Acid mine drainage within the park originates from abandoned deep mines. The flows emerge either through regraded spoil material, or from backfilled drift entries, and eventually contaminate the tributaries and major streams throughout the park. The proposed abatement technique involves intercepting the acid mine drainage at various points of emergence and conveying it through an underground piping system directly into Robinson Run.

The proposed surface reclamation has a three-fold objective. First, regrading and channelizing abandoned strip mines will reduce the percolation of water into the deep mines. Secondly, excavation of selected sections of the deep mine complex will remedy problems of acid mine drainage and subsidence. Thirdly, a program of revegetation will reduce erosion, enhance the recreational capacity and aesthetic quality of the park.

The present recreational facilities of the park consist of picnic groves and meadows situated on the ridges at the eastern end of the project area. The vegetation of the project area exhibits a generally predictable pattern of species, age, and density which are related to past and present land utilization. Before the advent of mining at the turn of the century, the land was used primarily for farming. However, the topography discouraged cultivation except on the relatively flat ridges and plateaus. Later, mining activities concentrated on the slopes where the Pittsburgh coal intersects the surface. Today, the hilltops and ridges are covered by overgrown fields. Usually the vegetation consists of grasses and trees such as crabapple, black cherry, birch and locust. Moving down the slopes, past strip mining has inhibited plant growth and produced a band of relatively sparse vegetation. Generally, tree and grass species that have an affinity for dry, shaley soils grow here. These populations include quaking aspen, pine, locust and crapapple, as well as a variety of tolerant grasses. In some locations, there is evidence of deliberate planting; while in others, it is obvious that revegetation was due, at least in part, to natural seeding. The stream valleys were relatively undisturbed, owing to their narrowness or swampy conditions. These valleys contain the remaining undisturbed forests. In some sections, even virgin trees remain, including oak, hickory, sycamore, maple and hemlock.

RELATIONSHIP OF THE PROPOSED RECLAMATION TO THE EXISTING LAND USE PLANS

A criteria used in formulating the abatement plan was the Simonds and Simonds land use plan for "West Park" developed in 1960. Reclamation and planting guidelines adhere to the designated land use categories and are intended to enhance the recreational and aesthetic potential of the park.

Environmental Impact During Reclamation: The reclamation performed on Work Areas 3, 4, 6, and 11 should have the least environmental impact. Little earthmoving will be done since only a modest amount of channelization within the abandoned strip mines is required. The reclamation technique is centered around soil rehabilitation and the planting of appropriate grasses, legumes, shrubs and trees. Access roads will be required for the lime, fertilizer and mulch spreading equipment and for a backhoe used in channelization.

The clearing and regrading required in Work Areas 1, 2, 5, 7, 8 and 10 will naturally have a more severe impact on the environment. Heavy equipment will be required, necessitating the construction of access roads. The construction sites for a time will be subject to erosion; however, the duration of the construction will be as brief as is practical. The work should be done in the dryest time of the year to reduce the likelihood of erosion. Soil preparation and planting will commence as soon as possible after work is completed.

The most severe environmental degradation will occur during the deep mine excavation and the subsequent regrading of Work Areas 9 and 12. This type of reclamation requires a significant amount of earthmoving and during construction there will be an increased potential for erosion. But, again, as with the previously described regrading operations, all possible precautions will be taken to insure minimum erosion. Soil conditioning and planting will commence as soon as practical to establish a vegetative cover consistent with park planning.

The acid mine drainage pipe interceptor system will be buried paralleling the streams below the frost line. The excavation and laying of pipe will contribute some siltation during construction. However, this temporary stress will have no lasting effect on water quality.

The total reclamation effort will involve only approximately 10% of the park area. While reclamation activities will temporarily increase the degree of environmental stress, primarily in the area of siltation during construction, recovery will be rapid and permanent upon completion of the work.

Environmental Impact After Reclamation: The underlying objectives of the proposed reclamation include reducing infiltration of water into the deep mine complex by regrading, minimizing erosion and enhancing the recreational and aesthetic quality by revegetating. The acid mine drainage pipe interceptor will reduce the amount of acid mine drainage entering the streams to the degree necessary to support viable fish populations.

Following construction, soil preparation and planting, the work areas should "recover" quickly, establishing a viable vegetative cover over the reclaimed areas. Drainage will be improved, impoundments and deep mine subsidence depressions will be eliminated, and the soil rehabilitated. These improvements will allow better land utilization and will indirectly improve water quality. On balance the recommended abatement will greatly enhance the park facilities, the brief period of environmental stress during construction will have no lasting effect on the park or surrounding areas.

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APPENDIX A

WATER QUALITY

UNITS

Flow	Gallons per minute
pH	Standard Units
Concentration	Milligrams per liter
Load	Pounds per day

STATION NO. SR-1

			ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
DATE	FLOW	PH	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 3/75	40	5.0	118	57	7	3	0.3	0	*****	*****	538	258	12.0	6
12/10/75	71	4.3	139	119	0	0	1.8	2	0.1	0	375	320	8.2	7
12/17/75	91	4.7	80	87	4	4	0.4	0	0.1	0	400	437	8.2	9
12/23/75	57	4.8	260	178	4	3	2.0	1	0.2	0	550	377	11.5	8
12/30/75	120	4.9	90	130	4	6	1.1	2	0.0	0	450	649	6.5	9
1/ 6/76	96	4.8	18	21	2	2	1.4	2	0.1	0	350	404	4.9	6
1/12/76	63	4.9	166	126	6	5	0.4	0	0.2	0	600	454	8.2	6
1/27/76	188	4.7	14	32	2	5	0.5	1	0.1	0	188	424	3.2	7
2/ 4/76	55	4.5	62	41	0	0	3.0	2	0.0	0	438	289	8.2	5
2/11/76	114	4.7	34	47	2	3	0.3	0	0.1	0	275	377	4.9	7
2/17/76	333	5.4	2	8	2	8	0.9	4	0.0	0	175	700	1.5	6
2/25/76	82	3.4	44	43	0	0	0.9	1	0.0	0	244	240	4.9	5
3/ 3/76	65	3.4	76	59	0	0	0.1	0	0.1	0	675	527	6.5	5
AVERAGE	106	4.1	57	73	2	3	0.9	1	0.1	0	330	420	5.2	7

STATION NO. SR-2

			ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
DATE	FLOW	PH	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 3/75	1420	5.2	62	1057	8	136	5.3	90	*****	*****	662	11290	10.0	171
12/11/75	1494	5.9	16	287	8	144	1.4	25	0.1	2	413	7410	6.5	117
12/17/75	1600	5.3	10	192	20	384	1.4	27	0.1	2	550	10569	4.9	94
12/23/75	1107	5.1	78	1037	4	53	4.6	61	0.2	3	725	9639	8.2	109
12/30/75	1959	5.3	24	565	10	235	2.3	54	0.0	0	550	12940	6.5	153
1/ 6/76	1742	4.8	158	3306	4	84	4.0	84	0.3	6	600	12553	6.5	136
1/12/76	1484	4.5	46	820	0	0	1.7	30	0.2	4	700	12476	9.8	175
1/27/76	4250	6.1	4	204	10	510	1.7	87	0.0	0	300	15312	4.9	250
2/ 4/76	2407	4.5	80	2313	0	0	2.6	75	0.0	0	550	15899	9.8	283
2/11/76	3523	6.1	6	254	10	423	2.3	97	0.0	0	244	10324	3.2	135
2/17/76	3858	6.1	0	0	16	741	2.0	93	0.0	0	88	4077	4.9	227
2/26/76	2220	3.7	104	2773	0	0	6.1	163	0.1	3	500	13331	10.5	280
3/ 3/76	2069	3.4	86	2137	0	0	4.6	114	0.1	2	550	13667	9.8	244
AVERAGE	2241	4.3	43	1150	8	209	2.9	77	0.1	2	427	11499	6.8	183

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-3

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	93	5.0	50	56	2	2	0.4	0	*****	*****	275	307	7.3	8
12/10/75	143	6.1	24	41	14	24	0.1	0	*****	*****	175	301	4.9	8
12/17/75	194	5.6	30	70	24	56	1.1	3	0.0	0	200	466	3.2	7
12/23/75	125	5.1	60	90	6	9	0.7	1	0.2	0	425	638	6.5	10
12/30/75	268	5.4	46	148	14	45	7.4	24	0.0	0	250	805	6.5	21
1/ 6/76	2047	4.7	30	738	2	49	*****	*****	0.1	2	275	6761	*****	*****
1/12/76	205	4.8	164	404	6	15	0.4	1	0.1	0	400	985	8.2	20
1/27/76	481	5.4	2	12	10	58	1.2	7	0.0	0	125	722	1.5	9
2/ 5/76	1507	4.3	42	760	0	0	3.9	71	0.0	0	338	6117	9.8	177
2/11/76	341	4.7	16	66	2	8	0.4	2	0.0	0	175	717	1.6	7
2/17/76	721	5.9	0	0	16	139	1.4	12	0.0	0	138	1195	1.6	14
2/26/76	341	3.9	78	319	0	0	1.7	7	0.1	0	375	1536	21.6	88
3/ 3/76	242	4.3	144	419	0	0	30.0	87	0.1	0	350	1017	8.2	24
AVERAGE	516	4.6	39	240	5	31	2.9	18	0.1	0	268	1659	5.3	33

STATION NO. SR-4

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	134	3.4	314	505	0	0	26.3	42	*****	*****	801	1289	54.4	88
12/10/75	152	3.2	592	1081	0	0	16.0	29	1.0	2	725	1323	50.0	91
12/17/75	134	3.2	318	512	0	0	13.4	22	0.7	1	800	1287	42.4	68
12/23/75	134	3.4	436	702	0	0	20.0	32	1.2	2	675	1086	37.8	61
12/30/75	282	3.3	250	847	0	0	12.8	43	0.6	2	625	2117	22.6	77
1/ 6/76	1717	3.2	240	4949	0	0	4.9	101	0.7	14	562	11589	6.5	134
1/12/76	183	3.3	274	602	0	0	12.8	28	1.0	2	750	1648	22.6	50
1/27/76	326	3.1	192	752	0	0	7.9	31	0.4	2	425	1664	21.6	85
2/ 5/76	1508	2.3	300	5433	0	0	11.4	206	0.6	11	700	12678	37.8	685
2/11/76	282	2.4	238	806	0	0	9.5	32	0.8	3	575	1947	22.6	77
2/17/76	500	3.0	124	745	0	0	5.3	32	0.6	4	350	2102	10.5	63
2/26/76	268	1.8	328	1056	0	0	25.0	80	0.8	3	560	1802	33.0	106
3/ 3/76	217	1.6	340	886	0	0	18.0	47	0.6	2	650	1694	20.0	52
AVERAGE	449	2.4	269	1452	0	0	10.4	56	0.7	4	602	3248	23.3	126

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-5

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 3/75	102	6.8	40	49	38	47	2.0	2	*****	*****	*****	*****	5.7	7
12/10/75	102	6.7	14	17	6	7	1.0	1	0.0	0	525	643	4.0	5
12/17/75	124	5.5	8	12	64	95	1.5	2	0.0	0	675	1005	4.9	7
12/23/75	81	5.8	*****	*****	50	49	1.1	1	0.0	0	775	754	4.9	5
12/30/75	148	5.8	24	43	54	96	0.7	1	0.0	0	650	1155	4.9	9
1/ 6/76	102	5.6	0	0	52	64	2.3	3	0.0	0	700	857	6.5	8
1/12/76	124	5.5	88	131	32	48	0.7	1	0.0	0	750	1117	6.5	10
1/27/76	318	5.4	10	38	28	107	0.5	2	0.0	0	375	1432	3.2	12
2/ 3/76	102	6.0	12	15	16	20	1.5	2	0.0	0	625	766	8.2	10
2/11/76	228	6.3	0	0	32	88	1.1	3	0.0	0	300	821	3.2	9
2/17/76	416	6.6	0	0	36	180	1.1	5	0.0	0	225	1124	1.6	8
2/25/76	124	5.1	10	15	8	12	1.1	2	0.0	0	588	876	6.5	10
3/ 3/76	124	4.9	20	30	4	6	1.7	3	0.0	0	550	819	4.9	7
AVERAGE	161	5.5	15	29	32	63	1.1	2	0.0	0	490	948	4.2	8

STATION NO. SR-6

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 2/75	81	6.8	58	56	16	16	3.7	4	*****	*****	713	694	9.0	9
12/10/75	318	6.5	13	50	38	145	1.4	5	0.0	0	400	1528	6.5	25
12/17/75	383	5.7	46	212	36	166	2.2	10	0.0	0	500	2300	8.2	38
12/23/75	200	5.2	54	130	6	14	2.0	5	0.1	0	525	1261	8.2	20
12/30/75	416	5.5	0	0	26	130	1.7	8	0.0	0	450	2248	6.5	32
1/ 6/76	416	5.0	62	310	6	30	3.3	16	0.0	0	425	2123	8.2	41
1/12/76	318	5.1	44	168	6	23	1.7	6	0.0	0	575	2196	6.5	25
1/27/76	976	6.1	0	0	22	258	1.7	20	0.0	0	188	2204	3.2	38
2/ 4/76	350	4.5	102	429	0	0	2.4	10	0.0	0	425	1786	11.0	46
2/11/76	890	5.9	4	43	18	192	1.4	15	0.0	0	275	2939	4.9	52
2/17/76	1880	6.2	0	0	26	587	1.4	32	0.1	2	100	2258	1.6	36
2/25/76	599	3.4	92	662	0	0	4.9	35	0.1	1	475	3417	12.0	86
3/ 3/76	487	3.2	144	842	0	0	12.8	75	0.1	1	625	3655	6.5	38
AVERAGE	563	4.1	33	223	18	120	2.8	19	0.0	0	326	2201	5.5	37

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-7

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	86	4.4	328	339	0	0	18.0	19	*****	*****	1051	1086	28.6	30
12/10/75	120	4.4	239	344	0	0	10.0	14	0.4	1	975	1405	23.4	34
12/17/75	100	4.6	354	425	2	2	11.5	14	0.2	0	1175	1411	21.8	26
12/23/75	86	4.6	256	264	2	2	3.6	4	0.5	1	1150	1188	20.0	21
12/30/75	120	4.5	168	242	0	0	10.0	14	0.7	1	900	1297	21.0	30
1/ 6/76	104	4.4	164	205	0	0	15.2	19	2.5	3	1025	1280	21.0	26
1/12/76	71	4.2	508	433	0	0	14.1	12	0.5	0	1125	959	22.6	19
1/27/76	185	4.2	92	204	0	0	7.9	18	0.1	0	575	1278	9.8	22
2/ 4/76	92	3.7	194	214	0	0	11.4	13	0.2	0	862	952	22.6	25
2/11/76	180	4.5	80	173	0	0	5.3	11	0.2	0	575	1243	8.2	18
2/17/76	316	4.5	50	190	0	0	5.3	20	0.7	3	500	1898	6.5	25
2/26/76	40	2.6	218	105	0	0	13.7	7	0.2	0	690	331	22.6	11
3/ 3/76	120	3.4	266	383	0	0	10.5	15	0.3	0	875	1261	9.8	14
AVERAGE	125	3.6	181	271	0	0	9.2	14	0.6	1	801	1199	15.4	23

STATION NO. SR-8

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	117	3.5	278	391	0	0	7.4	10	*****	*****	700	984	24.0	34
12/10/75	143	3.5	251	431	0	0	5.5	9	0.5	1	550	945	28.6	49
12/17/75	152	3.7	274	500	0	0	3.3	6	0.4	1	713	1302	22.6	41
12/23/75	134	3.7	50	80	0	0	6.1	10	0.8	1	775	1247	21.8	35
12/30/75	172	3.8	158	326	0	0	4.9	10	0.3	1	625	1291	21.0	43
1/ 6/76	194	3.6	150	349	0	0	2.0	5	0.4	1	675	1573	*****	*****
1/12/76	205	3.6	178	438	0	0	4.6	11	0.5	1	775	1908	21.6	53
1/27/76	326	3.3	146	572	0	0	4.5	18	0.1	0	475	1860	12.2	48
2/ 4/76	229	3.9	170	468	0	0	4.5	12	0.4	1	575	1581	21.6	59
2/11/76	357	3.2	122	523	0	0	4.0	17	0.3	1	400	1715	12.0	51
2/17/76	408	3.4	100	490	0	0	4.0	20	0.7	3	400	1960	9.8	48
2/25/76	311	2.2	198	740	0	0	9.2	34	0.6	2	650	2428	21.8	81
3/ 3/76	255	3.2	246	753	0	0	5.3	16	0.3	1	712	2180	11.4	35
AVERAGE	231	3.1	168	466	0	0	5.0	14	0.5	1	582	1613	17.4	48

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-9

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	51	6.6	14	9	44	27	0.1	0	*****	*****	401	246	1.0	1
12/10/75	73	6.4	4	4	49	43	0.7	1	0.0	0	325	285	1.6	1
12/17/75	93	5.9	6	7	62	69	0.4	0	0.1	0	163	182	1.6	2
12/23/75	41	5.8	4	2	56	28	1.1	1	0.0	0	700	345	1.5	1
12/30/75	79	5.7	0	0	66	63	0.7	1	0.0	0	275	261	1.6	2
1/ 6/76	69	6.1	0	0	72	60	0.7	1	0.0	0	200	166	1.5	1
1/12/76	64	5.9	0	0	34	26	0.7	1	0.1	0	300	231	1.5	1
1/27/76	850	6.8	0	0	50	510	0.5	5	0.0	0	188	1919	1.5	15
2/ 4/76	62	5.9	6	4	38	28	0.9	1	0.0	0	375	279	3.2	2
2/11/76	89	6.2	0	0	30	32	0.7	1	0.0	0	275	294	3.2	3
2/17/76	374	6.4	0	0	32	144	3.0	13	0.0	0	162	728	3.2	14
2/25/76	134	3.9	80	129	0	0	1.4	2	0.1	0	368	592	12.0	19
3/ 3/76	67	3.5	114	92	0	0	1.4	1	0.1	0	575	463	16.0	13
AVERAGE	157	4.5	10	19	42	79	1.1	2	0.0	0	244	461	3.1	6

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STATION NO. SR-10

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	148	4.4	332	590	0	0	5.9	10	*****	*****	663	1178	23.4	42
12/10/75	200	4.2	352	845	0	0	4.4	11	0.4	1	650	1561	20.8	50
12/17/75	228	4.6	220	602	2	5	4.6	13	0.2	1	675	1848	20.0	55
12/23/75	174	4.4	298	623	0	0	6.5	14	0.3	1	700	1463	20.8	43
12/30/75	257	4.6	316	975	2	6	4.9	15	0.2	1	700	2161	16.0	49
1/ 6/76	287	4.6	112	386	2	7	7.0	24	0.2	1	725	2499	20.0	69
1/12/76	200	4.3	368	884	0	0	4.9	12	0.6	1	800	1922	20.0	48
1/27/76	383	4.3	68	313	0	0	3.3	15	0.1	0	350	1610	9.8	45
2/ 4/76	257	3.8	230	710	0	0	5.6	17	0.2	1	675	2083	20.8	64
2/11/76	524	4.0	72	453	0	0	7.9	50	0.1	1	400	2517	8.2	52
2/17/76	718	4.5	34	293	0	0	3.0	26	0.4	3	250	2156	4.9	42
2/25/76	318	3.1	306	1169	0	0	4.9	19	0.1	0	560	2139	20.0	76
3/ 3/76	287	3.1	190	655	0	0	3.6	12	0.2	1	762	2626	20.0	69
AVERAGE	306	3.8	178	654	0	1	5.0	18	0.3	1	539	1982	14.7	54

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-11

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 3/75	425	6.4	54	276	17	87	1.7	9	*****	*****	638	3256	5.7	29
12/10/75	557	6.3	0	0	26	174	0.7	5	0.2	1	438	2930	3.2	21
12/17/75	751	5.3	58	523	40	361	1.4	13	0.0	0	575	5186	4.9	44
12/23/75	383	5.3	22	101	12	55	2.0	9	0.2	1	625	2875	6.5	30
12/30/75	1132	5.2	4	54	24	326	3.6	49	0.0	0	550	7477	4.9	67
1/ 6/76	1250	6.0	22	330	10	150	4.9	74	0.5	8	600	9007	8.2	123
1/12/76	652	5.0	26	204	4	31	2.7	21	0.4	3	700	5481	6.5	51
1/27/76	1958	6.2	2	47	16	376	2.0	47	0.1	2	300	7055	3.2	75
2/ 4/76	802	4.5	320	3082	0	0	2.1	20	0.0	0	625	6020	8.2	79
2/11/76	1689	6.0	10	203	18	365	1.4	28	0.0	0	325	6592	3.2	65
2/17/76	3079	6.4	0	0	26	961	1.7	63	0.0	0	175	6471	1.6	59
2/25/76	1191	3.8	168	2403	0	0	4.0	57	0.0	0	550	7867	9.8	140
3/ 3/76	963	3.5	80	925	0	0	4.6	53	0.0	0	912	10548	4.9	57
AVERAGE	1141	4.4	46	627	16	222	2.5	34	0.1	1	453	6213	4.7	65

STATION NO. SR-12

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 2/75	287	4.9	208	717	5	17	4.9	17	*****	*****	488	1682	16.0	55
12/11/75	1098	4.5	119	1569	0	0	3.7	49	0.1	1	413	5446	5.4	71
12/17/75	858	5.4	20	206	14	144	4.8	49	0.0	0	475	4895	8.2	84
12/23/75	559	4.9	106	712	6	40	3.6	24	0.0	0	1125	7553	9.8	66
12/30/75	317	5.6	0	0	26	99	5.3	20	0.0	0	125	476	6.5	25
1/ 6/76	1035	4.6	232	2884	2	25	6.5	81	0.2	2	500	6215	9.8	122
1/12/76	1031	4.6	348	4309	2	25	4.6	57	0.5	6	650	8048	16.0	198
1/29/76	1301	4.0	84	1312	0	0	4.9	77	0.2	3	400	6250	9.8	153
2/ 5/76	954	3.6	176	2016	0	0	3.9	45	0.1	1	550	6302	12.2	140
2/11/76	2148	5.1	10	258	4	103	7.4	191	0.2	5	250	6449	4.9	126
2/19/76	2495	5.3	10	300	4	120	4.0	120	0.4	12	275	8240	4.9	147
2/26/76	1209	3.2	126	1830	0	0	3.6	52	0.1	1	*****	*****	12.0	174
3/ 3/76	1153	3.8	198	2742	0	0	11.9	165	0.3	4	450	6231	16.0	222
AVERAGE	1111	4.0	109	1450	3	44	5.5	73	0.2	3	423	5649	9.1	122

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-13

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	166	4.6	56	112	2	4	2.0	4	*****	*****	750	1495	8.1	16
12/11/75	166	6.1	18	36	11	22	1.4	3	0.9	2	713	1421	5.7	11
12/18/75	198	5.6	12	29	16	38	5.5	13	0.1	0	750	1783	8.2	19
12/23/75	166	5.3	70	140	4	8	3.3	7	0.9	2	925	1844	6.5	13
12/31/75	232	5.6	76	212	12	33	1.4	4	0.6	2	750	2090	4.9	14
1/ 7/76	148	5.0	136	242	4	7	1.7	3	0.5	1	688	1223	6.5	12
1/13/76	232	4.7	206	574	4	11	2.3	6	0.6	2	875	2438	8.2	23
1/29/76	267	4.1	36	115	0	0	1.2	4	0.5	2	650	2084	6.5	21
2/ 5/76	267	4.6	40	128	2	6	2.1	7	0.1	0	725	2325	11.0	35
2/12/76	267	5.8	26	83	4	13	0.7	2	0.1	0	588	1885	4.9	16
2/19/76	383	5.8	0	0	12	55	3.3	15	0.2	1	475	2185	3.2	15
2/26/76	304	4.1	166	606	0	0	1.1	4	0.1	0	560	2045	8.2	30
3/ 4/76	467	5.2	18	101	10	56	0.7	4	0.0	0	338	1896	4.9	27
AVERAGE	251	4.7	61	183	6	20	1.9	6	0.3	1	631	1901	6.4	19

STATION NO. SR-14

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	174	7.5	8	17	36	75	1.7	4	*****	*****	538	1124	5.0	10
12/11/75	257	6.1	26	80	44	136	2.9	9	0.0	0	375	1157	4.9	15
12/18/75	228	6.0	6	16	38	104	1.8	5	0.0	0	575	1574	4.9	13
12/23/75	200	6.4	8	19	40	96	1.4	3	0.2	0	575	1381	3.2	8
12/31/75	416	5.9	60	300	34	170	2.0	10	0.1	0	425	2123	4.9	24
1/ 7/76	350	4.7	98	412	4	17	14.1	59	0.8	3	550	2312	21.8	92
1/13/76	287	4.9	210	724	4	14	3.6	12	0.7	2	600	2068	8.2	28
1/29/76	766	4.4	60	552	0	0	4.5	41	0.6	6	425	3910	8.2	75
2/ 5/76	150	3.9	114	205	0	0	3.3	6	0.0	0	550	991	9.8	18
2/12/76	240	5.2	14	40	6	17	4.0	12	0.0	0	450	1297	4.9	14
2/19/76	932	4.8	40	448	2	22	5.7	64	0.8	9	350	3918	4.9	55
2/26/76	383	4.0	68	313	0	0	12.8	59	0.1	0	600	2760	16.0	74
3/ 4/76	1223	5.7	0	0	12	176	4.3	63	0.1	1	425	6242	4.9	72
AVERAGE	431	4.6	46	240	12	64	5.2	27	0.4	2	458	2374	7.4	38

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-15

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	62	3.9	149	111	0	0	2.7	2	*****	*****	663	494	18.0	13
12/11/75	102	4.5	36	44	0	0	5.6	7	0.1	0	550	674	8.6	11
12/18/75	148	4.9	38	68	4	7	3.0	5	0.1	0	550	978	9.8	17
12/23/75	81	5.0	110	107	6	6	3.6	4	0.1	0	575	559	11.5	11
12/31/75	148	5.5	30	53	10	18	2.6	5	0.1	0	475	844	7.7	14
1/ 7/76	174	5.1	152	318	10	21	2.0	4	0.0	0	525	1097	8.2	17
1/13/76	81	5.0	130	126	6	6	3.0	3	0.1	0	775	754	9.8	10
1/29/76	174	4.7	18	38	4	8	2.4	5	0.0	0	450	940	6.5	14
2/ 5/76	102	4.6	44	54	2	2	4.9	6	0.0	0	588	720	9.8	12
2/12/76	148	3.9	66	117	0	0	2.0	4	0.0	0	500	889	6.5	12
2/19/76	257	6.3	0	0	24	74	1.4	4	0.0	0	200	617	3.2	10
2/26/76	905	4.6	28	304	0	0	2.7	29	0.0	0	500	5434	8.2	89
3/ 4/76	350	5.1	0	0	12	50	1.7	7	0.0	0	525	2207	3.2	13
AVERAGE	210	4.5	41	103	6	15	2.6	7	0.0	0	494	1247	7.4	19

STATION NO. SR-16

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	40	7.2	18	9	164	79	0.1	0	*****	*****	251	121	0.0	0
12/10/75	150	6.7	10	18	137	247	0.1	0	0.0	0	175	315	0.0	0
12/17/75	86	6.4	0	0	140	145	0.1	0	0.1	0	200	207	0.0	0
12/23/75	60	6.3	0	0	164	118	7.8	6	0.0	0	300	216	0.0	0
12/30/75	120	6.5	0	0	144	208	0.4	1	0.0	0	225	324	0.0	0
1/ 6/76	21	5.9	0	0	158	40	1.1	0	0.0	0	175	44	1.5	0
1/12/76	****	6.1	0	0	146	*****	0.1	*****	0.0	0	325	*****	1.5	*****
1/27/76	240	6.3	0	0	78	225	0.8	2	0.0	0	100	288	1.5	4
2/ 3/76	62	6.5	14	10	144	107	0.5	0	0.0	0	262	195	1.5	1
2/11/76	421	7.1	0	0	84	425	0.4	2	0.0	0	100	506	1.6	8
2/17/76	471	7.1	0	0	64	362	4.6	26	0.0	0	0	0	0.0	0
2/25/76	102	7.0	0	0	124	152	0.4	0	0.0	0	225	276	0.0	0
3/ 3/76	62	6.4	0	0	122	91	0.4	0	0.0	0	375	279	1.6	1
AVERAGE	153	6.4	2	3	100	183	1.7	3	0.0	0	126	231	0.7	1

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-17

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	43	3.1	410	212	0	0	10.2	5	*****	*****	863	446	28.6	15
12/10/75	47	3.2	331	187	0	0	7.3	4	0.6	0	738	417	42.4	24
12/17/75	70	3.1	418	351	0	0	6.6	6	0.7	1	775	652	33.0	28
12/23/75	58	3.2	354	247	0	0	7.4	5	0.7	0	700	488	22.6	16
12/30/75	69	3.2	330	273	0	0	6.1	5	0.4	0	650	539	21.0	17
1/ 6/76	152	3.2	410	748	0	0	7.9	14	0.4	1	400	730	20.0	37
1/12/76	114	3.2	210	288	0	0	6.3	9	0.3	0	725	993	22.6	31
1/27/76	129	2.0	186	288	0	0	5.9	9	0.3	0	575	891	20.8	32
2/ 3/76	102	2.8	320	392	0	0	7.9	10	0.5	1	738	904	28.6	35
2/11/76	109	2.7	222	291	0	0	6.2	8	0.4	1	560	733	20.8	27
2/17/76	218	2.4	170	445	0	0	6.7	18	0.7	2	562	1471	16.0	42
2/25/76	206	2.2	280	693	0	0	14.7	36	0.4	1	650	1608	23.4	58
3/ 3/76	141	2.9	320	542	0	0	9.6	16	0.5	1	300	508	24.4	41
AVERAGE	112	2.6	283	381	0	0	8.3	11	0.5	1	593	798	23.0	31

STATION NO. SR-19

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	11	3.6	394	52	0	0	14.0	2	*****	*****	750	99	21.8	3
12/10/75	17	3.2	*****	*****	0	0	7.7	2	0.7	0	625	128	20.8	4
12/17/75	32	3.4	306	118	0	0	10.0	4	0.6	0	713	274	28.6	11
12/23/75	37	3.4	336	149	0	0	11.9	5	0.9	0	825	367	24.1	11
12/30/75	65	3.3	468	365	0	0	10.5	8	0.6	0	700	546	23.4	18
1/ 6/76	78	3.1	498	467	0	0	21.3	20	0.7	1	725	679	22.6	21
1/12/76	91	3.1	474	518	0	0	12.8	14	0.7	1	775	847	23.4	26
1/27/76	89	2.2	234	250	0	0	10.5	11	0.4	0	588	628	22.6	24
2/ 4/76	55	2.9	302	199	0	0	10.0	7	0.5	0	700	462	28.6	19
2/11/76	53	2.5	264	168	0	0	13.2	8	0.5	0	712	453	23.4	15
2/17/76	100	2.7	190	228	0	0	10.5	13	0.7	1	550	661	20.0	24
2/25/76	120	2.0	140	202	0	0	22.0	32	0.7	1	785	1131	42.5	61
3/ 3/76	46	3.2	290	160	0	0	11.5	6	1.0	1	675	373	23.4	13
AVERAGE	61	2.7	327	240	0	0	13.8	10	0.7	1	697	511	26.2	19

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-20

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	30	6.5	18	6	30	11	0.3	0	*****	*****	888	320	6.5	2
12/10/75	22	6.5	8	2	44	12	0.4	0	0.0	0	650	172	4.9	1
12/17/75	43	5.5	14	7	36	19	0.4	0	0.1	0	625	323	6.5	3
12/23/75	41	6.7	18	9	34	17	0.7	0	0.2	0	750	369	9.9	5
12/30/75	30	5.6	16	6	32	12	1.4	1	0.0	0	750	270	6.5	2
1/ 6/76	28	5.7	86	29	36	12	1.4	0	0.0	0	650	219	4.9	2
1/12/76	35	5.1	102	43	20	8	0.1	0	0.0	0	850	357	4.9	2
1/27/76	80	7.4	0	0	20	19	0.5	0	0.0	0	450	432	3.2	3
2/ 4/76	36	6.5	4	2	24	10	0.2	0	0.1	0	675	292	3.2	1
2/11/76	75	5.8	0	0	16	14	1.1	1	0.0	0	550	495	3.2	3
2/17/76	60	6.2	0	0	24	17	0.4	0	0.0	0	375	270	1.6	1
2/25/76	41	5.3	12	6	16	8	0.4	0	0.0	0	540	266	3.2	2
3/ 3/76	41	5.1	0	0	14	7	0.4	0	0.1	0	712	351	4.9	2
AVERAGE	43	5.6	16	8	25	13	0.6	0	0.0	0	613	318	4.5	2

STATION NO. SR-21

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	16	8.0	9	2	72	14	0.3	0	*****	*****	575	110	4.9	1
12/12/75	20	6.3	8	2	88	21	0.7	0	0.0	0	450	108	4.9	1
12/18/75	33	6.2	6	2	86	34	3.0	1	0.0	0	600	238	3.2	1
12/23/75	27	6.2	0	0	76	25	3.2	1	0.0	0	725	235	0.4	0
12/31/75	126	6.1	12	18	84	127	0.4	1	0.0	0	500	757	3.2	5
1/ 7/76	45	5.6	120	65	68	37	2.3	1	0.0	0	562	304	3.2	2
1/13/76	46	5.9	34	19	54	30	3.6	2	0.0	0	675	373	4.9	3
1/29/76	60	6.1	0	0	52	37	0.5	0	0.1	0	475	342	4.9	4
2/ 5/76	39	5.6	0	0	36	17	0.5	0	0.0	0	588	275	4.9	2
2/12/76	55	6.9	0	0	62	41	0.1	0	0.0	0	500	330	3.2	2
2/19/76	38	6.3	0	0	70	32	0.7	0	0.0	0	375	171	3.2	1
2/26/76	38	5.9	0	0	42	19	1.1	1	0.0	0	575	262	4.9	2
3/ 4/76	52	5.6	0	0	66	41	1.4	1	0.0	0	450	281	3.2	2
AVERAGE	46	6.0	15	8	66	37	1.2	1	0.0	0	530	291	3.7	2

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-23

DATE	FLOW	PH	ACIDITY CONC	 LOAD	ALKALINITY CONC	 LOAD	TOTAL IRON CONC	 LOAD	FERROUS IRON CONC	 LOAD	SULFATES CONC	 LOAD	ALUMINUM CONC	 LOAD
12/ 5/75	119	3.7	172	246	0	0	2.0	3	*****	*****	825	1179	20.4	29
12/12/75	100	4.1	134	161	0	0	1.7	2	0.8	1	550	661	16.0	19
12/18/75	126	4.4	220	333	0	0	3.7	6	0.2	0	863	1306	20.8	31
12/23/75	130	4.8	184	287	6	9	4.3	7	0.7	1	775	1210	16.0	25
12/31/75	126	4.7	252	381	4	6	1.4	2	0.5	1	675	1021	8.6	13
1/ 7/76	210	4.6	340	857	4	10	1.7	4	0.3	1	725	1828	12.2	31
1/13/76	228	4.6	334	915	2	5	2.6	7	0.6	2	850	2327	12.2	33
1/29/76	166	3.7	96	191	0	0	2.0	4	0.4	1	650	1296	10.2	20
2/ 5/76	114	3.8	342	468	0	0	2.4	3	0.1	0	700	958	12.2	17
2/12/76	214	4.5	72	185	0	0	2.3	6	15.0	39	688	1768	9.8	25
2/19/76	250	4.4	82	246	0	0	0.7	2	0.4	1	575	1726	8.2	25
2/26/76	195	3.7	114	267	0	0	2.0	5	0.1	0	712	1667	16.0	37
3/ 4/76	360	3.8	82	355	0	0	1.7	7	0.1	0	650	2810	8.2	35
AVERAGE	180	4.0	174	376	1	2	2.1	4	1.8	4	704	1520	12.2	26

STATION NO. SR-25

DATE	FLOW	PH	ACIDITY CONC	 LOAD	ALKALINITY CONC	 LOAD	TOTAL IRON CONC	 LOAD	FERROUS IRON CONC	 LOAD	SULFATES CONC	 LOAD	ALUMINUM CONC	 LOAD
12/ 5/75	10	7.8	10	1	101	12	0.4	0	*****	*****	862	104	4.0	0
12/11/75	30	6.4	20	7	82	30	0.7	0	0.0	0	788	284	4.9	2
12/17/75	24	6.4	20	6	84	24	1.6	1	0.0	0	650	187	6.5	2
12/23/75	25	6.3	16	5	100	30	1.7	1	0.0	0	725	218	6.5	2
12/30/75	92	5.3	6	7	22	24	10.0	11	0.0	0	425	470	16.0	18
1/ 6/76	26	5.7	28	9	48	15	2.3	1	0.0	0	725	226	8.2	3
1/12/76	20	5.6	22	5	48	12	1.4	0	0.0	0	750	180	6.5	2
1/27/76	35	5.7	12	5	20	8	5.6	2	0.0	0	450	189	9.8	4
2/ 5/76	27	6.3	46	15	64	21	0.9	0	0.0	0	700	227	4.9	2
2/11/76	69	6.0	4	3	30	25	3.3	3	0.0	0	425	352	4.9	4
2/17/76	50	5.9	2	1	14	8	1.7	1	0.4	0	462	277	3.2	2
2/26/76	30	5.8	0	0	28	10	3.0	1	0.0	0	560	202	8.2	3
3/ 3/76	30	6.0	0	0	48	17	1.4	1	0.0	0	525	189	4.9	2
AVERAGE	36	5.9	11	5	42	18	3.8	2	0.0	0	552	239	7.9	3

NOTE ***=NO DATA AVAILABLE

STATION NO. SR-26

DATE	FLOW	PH	ACIDITY CONC	 LOAD	ALKALINITY CONC	 LOAD	TOTAL IRON CONC	 LOAD	FERROUS IRON CONC	 LOAD	SULFATES CONC	 LOAD	ALUMINUM CONC	 LOAD
12/ 5/75	30	4.0	68	24	0	0	13.9	5	*****	*****	1200	432	12.1	4
12/11/75	40	4.9	180	86	4	2	10.0	5	1.2	1	350	168	5.4	3
12/17/75	43	5.4	140	72	26	13	9.1	5	0.1	0	413	213	24.4	13
12/23/75	52	4.1	198	124	0	0	22.0	14	1.7	1	675	422	20.8	13
12/30/75	156	4.5	108	202	0	0	35.0	66	0.1	0	450	843	16.0	30
1/ 6/76	116	3.4	430	599	0	0	33.8	47	0.9	1	725	1010	33.0	46
1/12/76	74	3.4	316	281	0	0	37.0	33	2.0	2	925	822	38.0	34
1/27/76	123	3.8	78	115	0	0	14.0	21	0.2	0	425	628	12.0	18
2/ 5/76	57	2.7	234	160	0	0	19.5	13	0.3	0	775	531	22.6	15
2/11/76	166	4.7	44	88	2	4	8.3	17	0.3	1	350	694	9.8	20
2/17/76	319	5.0	16	61	4	15	9.2	35	0.4	2	300	1149	8.2	31
2/26/76	158	2.2	236	448	0	0	30.5	58	0.4	1	540	1025	21.6	41
3/ 3/76	107	3.5	216	278	0	0	21.9	28	0.7	1	575	739	24.4	31
AVERAGE	111	3.1	147	195	2	3	20.0	27	0.6	1	502	668	17.3	23

STATION NO. SR-28

DATE	FLOW	PH	ACIDITY CONC	 LOAD	ALKALINITY CONC	 LOAD	TOTAL IRON CONC	 LOAD	FERROUS IRON CONC	 LOAD	SULFATES CONC	 LOAD	ALUMINUM CONC	 LOAD
12/ 5/75	63	3.9	209	158	0	0	2.7	2	*****	*****	713	539	21.2	16
12/11/75	67	4.3	160	129	0	0	1.4	1	0.5	0	513	413	8.6	7
12/17/75	86	4.9	120	124	4	4	1.5	2	0.0	0	675	697	9.8	10
12/23/75	92	4.9	138	152	4	4	3.0	3	0.3	0	575	635	11.5	13
12/30/75	291	5.3	0	0	26	91	15.2	53	0.0	0	150	524	7.7	27
1/ 6/76	150	4.5	274	494	0	0	10.0	18	0.1	0	475	856	22.6	41
1/12/76	97	4.2	280	326	0	0	3.9	5	0.6	1	675	786	12.2	14
1/27/76	133	4.2	90	144	0	0	2.4	4	0.1	0	362	578	9.8	16
2/ 5/76	120	3.6	110	159	0	0	3.9	6	0.1	0	575	829	16.0	23
2/11/76	200	4.5	56	135	0	0	7.4	18	0.1	0	425	1021	8.2	20
2/19/76	343	4.2	64	264	0	0	3.3	14	0.3	1	375	1545	8.2	34
2/25/76	200	3.0	156	375	0	0	5.3	13	0.2	0	575	1381	16.0	38
3/ 3/76	150	3.4	190	342	0	0	3.3	6	0.2	0	575	1036	20.0	36
AVERAGE	153	3.8	117	215	4	8	6.0	11	0.2	0	453	834	12.3	23

NOTE ***=NO DATA AVAILABLE

STATION NO. PR-1

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	4	7.2	15	1	118	6	4.0	0	*****	*****	325	16	0.0	0
12/11/75	9	6.5	23	2	118	13	1.6	0	0.1	0	338	37	0.0	0
12/17/75	16	5.6	68	13	114	22	1.5	0	0.1	0	375	72	0.0	0
12/23/75	5	6.3	0	0	120	7	2.3	0	0.0	0	275	17	0.0	0
12/30/75	32	5.6	0	0	94	36	4.6	2	0.0	0	225	86	1.6	1
1/ 6/76	20	6.2	54	13	110	26	3.0	1	0.0	0	325	78	1.5	0
1/12/76	6	6.1	0	0	116	8	7.9	1	0.1	0	475	34	1.5	0
1/27/76	34	6.3	0	0	74	30	1.7	1	0.0	0	150	61	1.5	1
2/ 5/76	5	7.0	0	0	100	6	16.2	1	0.0	0	262	16	1.5	0
2/11/76	48	7.1	0	0	64	37	0.7	0	0.0	0	138	80	0.0	0
2/17/76	65	7.0	0	0	68	53	1.1	1	0.0	0	138	108	1.6	1
2/26/76	17	6.1	0	0	94	19	1.4	0	0.0	0	244	50	0.0	0
3/ 3/76	9	6.7	0	0	102	11	2.7	0	0.0	0	288	31	1.6	0
AVERAGE	21	6.2	9	2	85	21	2.3	1	0.0	0	211	53	1.0	0

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STATION NO. PR-5

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/11/75	0	2.9	672	0	0	0	30.5	0	4.0	0	763	0	37.8	0
12/18/75	0	3.0	514	0	0	0	35.0	0	1.4	0	825	0	47.0	0
12/31/75	19	3.1	526	120	0	0	28.8	7	3.5	1	700	160	24.2	6
1/ 7/76	32	2.9	802	308	0	0	76.3	29	9.5	4	1075	413	42.5	16
1/13/76	21	3.1	812	205	0	0	68.0	17	15.0	4	1275	322	38.0	10
1/29/76	30	2.0	516	186	0	0	77.0	28	12.5	5	1025	369	49.0	18
2/ 5/76	17	1.9	388	79	0	0	57.0	12	1.4	0	1000	204	47.0	10
2/12/76	9	2.5	606	66	0	0	66.0	7	1.6	0	1100	119	32.5	4
2/19/76	69	2.4	630	522	0	0	96.0	80	0.7	1	1150	953	47.0	39
2/26/76	35	1.9	666	280	0	0	66.0	28	4.5	2	900	378	49.0	21
3/ 4/76	32	1.3	484	186	0	0	57.5	22	1.2	0	1062	408	48.0	18
AVERAGE	24	2.1	616	177	0	0	72.2	21	5.1	1	1049	302	44.2	13

NOTE ***=NO DATA AVAILABLE

STATION NO. PR-6

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/11/75	0	2.4	1719	0	0	0	290.0	0	5.0	0	1738	0	80.0	0
12/18/75	0	2.6	1618	0	0	0	347.5	0	5.5	0	1900	0	3.2	0
12/31/75	0	3.0	570	0	0	0	108.8	0	4.5	0	850	0	33.0	0
1/ 7/76	4	2.9	1014	49	0	0	76.3	4	1.5	0	1475	71	61.2	3
1/29/76	7	2.0	872	73	0	0	114.0	10	10.0	1	1350	113	51.0	4
2/ 5/76	4	1.9	1004	48	0	0	73.5	4	2.0	0	1475	71	61.0	3
2/12/76	2	2.2	838	20	0	0	68.5	2	1.5	0	1425	34	80.0	2
2/19/76	32	2.6	568	218	0	0	110.0	42	4.0	2	862	331	33.0	13
2/26/76	6	1.6	1298	94	0	0	184.0	13	2.5	0	1500	108	122.5	9
AVERAGE	6	2.1	760	56	0	0	112.0	8	4.2	0	1103	81	50.9	4

STATION NO. PR-8

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/11/75	11	6.6	21	3	172	23	0.7	0	0.0	0	110	15	0.0	0
12/18/75	6	6.5	0	0	168	12	3.0	0	0.0	0	125	9	1.6	0
12/23/75	5	6.3	0	0	156	9	4.9	0	0.0	0	250	15	1.5	0
12/31/75	21	6.2	0	0	126	32	0.1	0	0.0	0	150	38	1.6	0
1/ 6/76	16	5.9	52	10	132	25	2.3	0	0.0	0	225	43	1.5	0
1/12/76	5	5.8	62	4	148	9	0.1	0	0.1	0	200	12	1.5	0
1/29/76	10	6.7	0	0	112	13	1.2	0	0.1	0	188	23	1.5	0
2/ 5/76	7	7.7	0	0	140	12	0.2	0	0.0	0	75	6	1.5	0
2/12/76	13	6.7	0	0	110	17	0.4	0	0.0	0	50	8	1.6	0
2/19/76	34	6.4	12	5	84	34	0.7	0	0.0	0	88	36	1.6	1
2/26/76	12	6.6	0	0	122	18	0.7	0	0.0	0	138	20	0.0	0
3/ 4/76	64	5.4	0	0	66	51	2.0	2	0.0	0	150	115	1.6	1
AVERAGE	17	6.1	9	2	104	21	1.3	0	0.0	0	139	28	1.4	0

NOTE ***=NO DATA AVAILABLE

STATION NO. PR-9

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/11/75	34	4.2	312	127	0	0	2.2	1	0.5	0	513	209	21.6	9
12/18/75	46	4.4	242	134	0	0	2.6	1	0.3	0	600	331	21.8	12
12/23/75	80	4.6	208	200	2	2	13.2	13	0.5	0	375	360	22.4	22
12/31/75	89	4.7	238	254	4	4	2.0	2	0.3	0	425	454	12.2	13
1/ 6/76	109	3.7	120	157	0	0	3.6	5	0.4	1	550	720	16.0	21
1/12/76	91	3.7	430	470	0	0	2.3	3	0.5	1	725	792	21.6	24
1/29/76	138	2.7	170	282	0	0	4.9	8	0.5	1	475	787	20.0	33
2/ 5/76	100	2.6	262	315	0	0	3.9	5	0.3	0	650	781	21.6	26
2/12/76	126	3.2	220	333	0	0	2.7	4	0.5	1	625	946	21.6	33
2/19/76	182	3.2	148	323	0	0	3.0	7	0.6	1	500	1093	16.0	35
2/26/76	153	2.0	280	514	0	0	4.6	8	0.5	1	738	1356	28.6	53
3/ 4/76	248	3.9	64	191	0	0	3.3	10	0.1	0	438	1305	12.2	36
AVERAGE	116	2.9	197	275	0	1	3.9	6	0.4	1	545	761	18.8	26

STATION NO. PR-11

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
1/ 7/76	36	3.5	372	161	0	0	7.4	3	0.7	0	738	319	12.2	5
2/ 5/76	55	2.5	222	147	0	0	5.2	3	0.2	0	712	470	12.2	8
2/12/76	41	3.3	152	75	0	0	3.6	2	0.6	0	712	351	12.0	6
2/19/76	48	3.4	124	71	0	0	5.3	3	1.2	1	600	346	9.8	6
2/26/76	40	2.3	192	92	0	0	4.6	2	0.2	0	650	312	10.5	5
3/ 4/76	48	1.7	108	62	0	0	6.1	4	0.1	0	550	317	8.2	5
AVERAGE	45	2.3	189	101	0	0	5.3	3	0.5	0	657	353	10.8	6

NOTE ***=NO DATA AVAILABLE

STATION NO. PR-13

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	5	3.2	542	33	0	0	37.5	2	*****	*****	1200	72	44.0	3
12/11/75	4	3.0	515	25	0	0	20.0	1	1.5	0	1175	56	1.4	0
12/18/75	7	3.2	698	59	0	0	35.0	3	1.0	0	1300	109	80.0	7
12/23/75	7	3.5	396	33	0	0	22.0	2	0.9	0	1275	107	33.0	3
12/11/75	11	3.4	560	74	0	0	25.0	3	3.5	0	1475	195	22.6	3
1/ 7/76	10	3.3	708	85	0	0	33.8	4	2.0	0	1125	135	28.6	3
1/13/76	11	3.3	668	88	0	0	26.5	4	3.5	0	1125	149	22.6	3
1/29/76	12	2.3	122	18	0	0	26.0	4	5.0	1	975	141	33.0	5
2/ 5/76	12	2.0	292	42	0	0	22.5	3	0.7	0	975	141	28.6	4
2/12/76	15	2.6	344	62	0	0	21.5	4	0.6	0	1000	180	22.6	4
2/19/76	17	2.8	242	49	0	0	16.0	4	7.0	1	812	166	20.0	4
2/26/76	18	2.5	290	63	0	0	24.5	5	0.5	0	710	153	23.4	5
3/ 4/76	28	1.7	222	75	0	0	12.8	4	0.2	0	738	248	9.8	3
AVERAGE	12	2.4	374	54	0	0	22.8	3	2.3	0	982	142	24.9	4

STATION NO. PR-21

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	4	4.8	240	12	9	0	2.3	0	*****	*****	800	38	20.2	1
12/10/75	6	4.3	216	16	0	0	9.5	1	0.4	0	663	48	24.2	2
12/17/75	8	4.6	448	43	4	0	3.3	0	0.3	0	800	77	20.8	2
12/23/75	10	4.6	178	21	6	1	4.3	1	0.6	0	725	87	20.8	2
12/30/75	12	4.5	248	36	0	0	2.3	0	0.2	0	725	104	16.0	2
1/ 6/76	15	4.5	356	64	0	0	9.2	2	0.2	0	750	135	21.0	4
2/ 4/76	9	3.8	154	17	0	0	1.5	0	0.1	0	675	73	20.0	2
2/11/76	14	4.3	92	15	0	0	1.4	0	0.1	0	375	63	8.1	1
2/17/76	18	4.2	68	15	0	0	4.3	1	0.3	0	400	86	9.8	2
2/25/76	15	2.8	158	28	0	0	1.7	0	0.2	0	540	97	16.0	3
3/ 5/76	13	3.5	222	35	0	0	1.7	0	0.2	0	575	90	20.8	3
AVERAGE	11	3.7	202	27	1	0	3.7	1	0.3	0	604	82	16.8	2

NOTE ***=NO DATA AVAILABLE

STATION NO. PR-26

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	18	3.6	500	108	0	0	12.8	3	*****	*****	663	143	36.9	8
12/10/75	26	3.0	550	172	0	0	4.0	1	3.0	1	650	203	8.6	3
12/17/75	16	3.1	314	60	0	0	9.1	2	0.5	0	763	147	23.4	4
12/23/75	19	3.4	298	68	0	0	7.9	2	2.5	1	800	183	24.1	5
12/30/75	15	3.3	214	39	0	0	8.3	1	0.5	0	875	158	21.0	4
1/ 6/76	22	3.2	426	113	0	0	10.5	3	1.3	0	750	198	21.0	6
1/12/76	29	3.4	418	146	0	0	8.3	3	1.5	1	775	270	21.6	8
1/27/76	20	2.7	222	53	0	0	7.9	2	0.3	0	600	144	20.8	5
2/ 4/76	19	2.9	258	59	0	0	7.1	2	0.3	0	675	154	20.8	5
2/11/76	19	2.3	200	46	0	0	6.6	2	0.7	0	650	148	20.0	5
2/17/76	32	3.0	154	59	0	0	6.1	2	1.1	0	600	231	21.8	8
2/25/76	23	2.5	206	57	0	0	9.2	3	0.3	0	650	180	21.6	6
3/ 3/76	38	3.3	240	110	0	0	3.0	1	0.2	0	563	257	6.5	3
AVERAGE	23	2.9	306	84	0	0	7.3	2	1.1	0	679	186	19.4	5

STATION NO. PR-27

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	12	3.6	420	61	0	0	6.8	1	*****	*****	825	119	22.3	3
12/10/75	10	*****	*****	*****	*****	*****	6.6	1	*****	*****	788	95	28.6	3
12/17/75	12	3.2	474	68	0	0	6.6	1	0.5	0	938	135	28.6	4
12/23/75	13	3.4	320	50	0	0	4.6	1	0.6	0	775	121	33.0	5
12/30/75	13	3.2	462	72	0	0	4.9	1	0.4	0	875	137	24.2	4
1/ 6/76	16	3.2	456	88	0	0	8.3	2	0.5	0	775	149	21.8	4
1/12/76	19	3.3	440	100	0	0	6.6	2	0.6	0	800	183	21.6	5
1/27/76	19	2.1	202	46	0	0	5.6	1	0.4	0	588	134	20.0	5
2/ 4/76	17	2.9	256	52	0	0	12.9	3	0.9	0	588	120	21.6	4
2/11/76	20	2.6	204	49	0	0	4.0	1	0.3	0	600	144	12.0	3
2/17/76	35	2.5	164	69	0	0	2.3	1	0.5	0	*****	*****	16.0	7
2/25/76	43	2.5	162	84	0	0	6.6	3	0.2	0	600	310	20.0	10
3/ 3/76	34	3.1	244	100	0	0	3.3	1	0.2	0	500	204	11.4	5
AVERAGE	20	2.7	288	70	0	0	5.7	1	0.5	0	635	154	19.8	5

NOTE ***=NO DATA AVAILABLE

STATION NO. 4668

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	43	3.6	438	226	0	0	24.8	13	*****	*****	825	426	28.6	15
12/10/75	54	3.1	448	291	0	0	24.4	16	8.0	5	913	592	48.0	31
12/17/75	35	3.2	550	231	0	0	19.3	8	0.8	0	1050	441	42.4	18
12/23/75	46	3.4	328	181	0	0	21.0	12	4.0	2	800	442	33.0	18
12/30/75	39	3.2	474	222	0	0	17.5	8	0.4	0	925	433	24.2	11
1/ 6/76	43	3.4	530	274	0	0	21.3	11	1.3	1	750	387	21.8	11
1/12/76	52	3.3	251	157	0	0	18.0	11	5.5	3	725	453	8.6	5
1/27/76	63	2.7	232	176	0	0	18.0	14	0.5	0	700	530	21.6	16
2/ 4/76	71	3.0	290	247	0	0	14.0	12	0.4	0	650	554	21.6	18
2/11/76	67	2.7	250	201	0	0	15.2	12	2.5	2	540	435	23.4	19
2/17/76	62	2.5	224	167	0	0	15.8	12	6.2	5	650	484	20.8	15
2/25/76	88	2.4	216	228	0	0	20.0	21	0.4	0	600	634	21.6	23
3/ 3/76	83	1.5	226	225	0	0	16.7	17	0.4	0	712	710	33.0	33
AVERAGE	57	2.4	315	217	0	0	18.5	13	2.4	2	728	502	26.2	18

STATION NO. 4669

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	30	3.4	376	135	0	0	5.3	2	*****	*****	862	311	40.0	14
12/11/75	30	2.9	310	112	0	0	6.0	2	0.6	0	688	248	22.6	8
12/17/75	38	3.2	562	256	0	0	4.7	2	0.5	0	1050	479	33.0	15
12/23/75	49	3.2	316	186	0	0	6.1	4	0.5	0	950	559	28.6	17
12/31/75	56	3.3	280	188	0	0	4.0	3	0.7	0	775	521	23.4	16
1/ 6/76	103	3.1	468	579	0	0	3.9	5	0.4	0	800	990	21.0	26
1/12/76	99	3.2	486	578	0	0	7.4	9	0.3	0	875	1040	21.6	26
1/29/76	100	2.5	212	255	0	0	3.6	4	0.2	0	675	811	22.6	27
2/ 4/76	120	2.9	244	352	0	0	3.0	4	0.4	1	762	1098	21.6	31
2/11/76	136	2.6	224	366	0	0	3.0	5	0.3	0	712	1163	21.6	35
2/17/76	107	2.5	194	249	0	0	5.3	7	0.2	0	575	739	20.0	26
2/26/76	144	2.2	270	467	0	0	5.3	9	0.5	1	738	1276	22.8	39
3/ 3/76	98	3.0	288	339	0	0	3.6	4	0.3	0	600	706	24.4	29
AVERAGE	85	2.8	305	312	0	0	4.5	5	0.4	0	746	765	23.2	24

NOTE ***=NO DATA AVAILABLE

STATION NO. 4671

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	****	*****	880	*****	*****	0	87.5	*****	*****	0	1338	*****	75.0	*****
12/10/75	25	3.5	342	103	0	0	12.6	4	0.9	0	1113	334	42.4	13
12/17/75	18	3.7	646	140	0	0	13.4	3	0.5	0	1375	297	42.4	9
12/23/75	29	3.7	356	124	0	0	11.4	4	0.7	0	1375	479	24.1	8
12/30/75	52	3.6	298	186	0	0	25.0	16	0.5	0	1175	734	24.2	15
1/ 6/76	33	3.5	618	245	0	0	21.3	8	0.6	0	1300	515	28.6	11
1/12/76	40	3.5	650	312	0	0	33.0	16	0.1	0	1275	612	38.0	18
1/27/76	55	3.1	182	120	0	0	7.1	5	0.3	0	812	536	22.6	15
2/ 4/76	44	3.1	288	152	0	0	14.0	7	0.6	0	975	515	24.4	13
2/11/76	74	3.2	202	180	0	0	9.5	8	0.3	0	812	722	20.0	18
2/17/76	72	2.6	192	166	0	0	11.5	10	1.2	1	788	681	21.8	19
2/25/76	72	2.5	288	249	0	0	24.5	21	0.5	0	736	636	24.2	21
3/ 3/76	50	1.5	304	183	0	0	12.8	8	0.5	0	937	563	12.2	7
AVERAGE	47	2.5	319	180	0	0	16.2	9	0.5	0	978	552	24.8	14

STATION NO. 4672

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 3/75	20	3.7	664	159	0	0	35.0	8	*****	*****	1113	267	12.5	3
12/10/75	35	3.1	386	162	0	0	27.8	12	1.3	1	1200	504	50.0	21
12/17/75	33	3.4	472	187	0	0	27.5	11	0.6	0	1250	495	48.0	19
12/23/75	43	4.1	424	219	0	0	20.0	10	1.5	1	1100	568	37.8	20
12/30/75	33	3.4	702	278	0	0	17.5	7	0.7	0	1100	436	24.2	10
1/ 6/76	26	3.4	628	196	0	0	28.6	9	1.3	0	1125	351	42.6	13
1/12/76	59	3.3	590	418	0	0	33.0	23	1.3	1	1225	868	42.6	30
1/27/76	58	3.0	224	156	0	0	20.0	14	0.3	0	950	662	21.6	15
2/ 4/76	37	3.7	282	125	0	0	19.5	9	0.5	0	1000	444	37.8	17
2/11/76	55	3.1	194	128	0	0	13.7	9	0.3	0	862	569	20.8	14
2/17/76	59	3.1	164	116	0	0	20.0	14	2.5	2	738	523	20.0	14
2/25/76	27	2.4	314	102	0	0	43.5	14	0.5	0	1000	324	24.2	8
3/ 3/76	44	3.1	378	200	0	0	14.6	8	0.6	0	875	462	20.0	11
AVERAGE	41	3.1	385	188	0	0	23.3	11	1.0	1	1019	498	30.5	15

NOTE ***=NO DATA AVAILABLE

STATION NO. 4673

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	8	3.4	*****	*****	0	0	1.7	0	*****	*****	750	72	42.3	4
12/10/75	8	2.9	461	44	0	0	30.5	3	1.0	0	550	53	47.0	5
12/17/75	14	3.0	486	82	0	0	27.5	5	0.7	0	625	105	37.8	6
12/23/75	4	3.1	744	36	0	0	25.0	1	1.8	0	725	35	33.0	2
12/30/75	51	3.0	454	278	0	0	32.5	20	0.7	0	500	306	21.8	13
1/ 6/76	73	2.9	374	328	0	0	37.5	33	0.8	1	575	504	*****	*****
1/12/76	29	3.1	386	134	0	0	33.0	11	1.1	0	675	235	24.2	8
1/27/76	37	2.8	262	116	0	0	21.0	9	0.6	0	450	200	21.6	10
2/ 5/76	27	2.0	620	201	0	0	31.5	10	0.8	0	625	203	42.5	14
2/11/76	24	2.0	354	102	0	0	23.0	7	0.8	0	500	144	21.6	6
2/17/76	73	2.3	172	151	0	0	13.7	12	0.6	1	300	263	12.0	11
2/26/76	56	1.6	384	258	0	0	57.5	39	0.8	1	588	395	22.6	15
3/ 3/76	22	1.8	522	138	0	0	37.5	10	0.7	0	675	178	21.6	6
AVERAGE	33	2.2	396	156	0	0	31.3	12	0.8	0	527	207	21.0	8

STATION NO. 4675

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 2/75	171	2.9	736	1512	0	0	37.5	77	*****	*****	1050	2156	75.0	154
12/10/75	67	2.9	744	599	0	0	30.5	25	1.6	1	1113	896	74.0	60
12/17/75	120	3.0	822	1185	0	0	27.5	40	1.3	2	1050	1513	80.0	115
12/23/75	92	3.0	668	738	0	0	20.5	23	1.6	2	1100	1215	37.5	41
12/30/75	136	3.1	396	647	0	0	17.5	29	1.1	2	975	1592	47.0	77
1/ 6/76	138	3.0	574	951	0	0	6.7	11	0.7	1	875	1450	38.0	63
1/12/76	144	3.0	612	1058	0	0	14.6	25	0.8	1	950	1643	33.0	57
1/27/76	141	2.9	372	630	0	0	16.2	27	0.6	1	775	1312	42.5	72
2/ 5/76	120	2.8	366	527	0	0	12.9	19	0.7	1	812	1170	49.0	71
2/11/76	120	2.1	384	553	0	0	14.6	21	0.6	1	838	1208	31.0	45
2/17/76	145	2.3	302	526	0	0	13.7	24	0.6	1	738	1285	28.6	50
2/26/76	200	1.8	442	1062	0	0	26.5	64	0.8	2	670	1609	49.0	118
3/ 3/76	200	2.8	468	1124	0	0	23.0	55	0.8	2	962	2311	33.0	79
AVERAGE	138	2.5	516	855	0	0	20.4	34	0.9	1	899	1489	46.5	77

NOTE ***=NO DATA AVAILABLE

STATION NO. 4676

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 2/75	17	3.6	298	61	0	0	17.1	3	*****	*****	550	112	22.2	5
12/11/75	15	3.1	268	48	0	0	13.6	2	4.5	1	450	81	24.2	4
12/17/75	20	3.2	374	90	0	0	14.6	4	0.5	0	688	165	24.4	6
12/23/75	25	3.2	332	100	0	0	12.8	4	5.0	2	725	218	21.8	7
12/30/75	45	3.4	258	139	0	0	12.3	7	0.8	0	363	196	16.0	9
1/ 6/76	43	3.3	354	183	0	0	11.0	6	3.5	2	550	284	16.0	8
1/12/76	57	3.2	358	245	0	0	9.2	6	3.0	2	600	411	16.0	11
1/27/76	44	2.7	178	94	0	0	7.5	4	0.3	0	450	238	16.0	8
2/ 5/76	35	2.4	234	98	0	0	6.3	3	0.2	0	500	210	20.0	8
2/11/76	77	2.7	132	122	0	0	4.6	4	1.1	1	275	254	9.8	9
2/17/76	47	2.5	160	90	0	0	7.0	4	3.0	2	400	226	12.0	7
2/26/76	82	2.2	202	199	0	0	9.6	9	0.2	0	550	542	21.8	21
3/ 3/76	61	3.1	256	188	0	0	2.7	2	0.3	0	675	495	11.4	8
AVERAGE	44	2.8	243	127	0	0	8.5	4	1.6	1	503	264	16.4	9

STATION NO. 4677

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 2/75	14	3.4	352	59	0	0	16.9	3	*****	*****	735	124	6.5	1
12/11/75	8	3.0	534	51	0	0	13.9	1	0.7	0	525	50	24.2	2
12/17/75	18	3.0	418	90	0	0	14.6	3	0.6	0	675	146	24.4	5
12/23/75	43	3.2	300	155	0	0	14.4	7	0.7	0	700	361	21.8	11
12/30/75	60	3.1	348	251	0	0	14.1	10	0.4	0	550	396	16.0	12
1/ 6/76	46	3.0	360	199	0	0	21.3	12	0.7	0	600	331	22.6	12
1/12/76	47	3.0	262	148	0	0	23.0	13	0.6	0	650	367	21.0	12
1/27/76	67	2.9	240	193	0	0	20.0	16	0.4	0	500	402	20.8	17
2/ 5/76	39	2.2	252	118	0	0	14.0	7	0.4	0	550	258	21.6	10
2/11/76	39	2.4	234	110	0	0	11.5	5	0.5	0	475	222	21.8	10
2/17/76	77	2.5	216	200	0	0	12.8	12	0.4	0	475	439	16.0	15
2/26/76	120	1.4	374	539	0	0	28.5	41	0.9	1	560	807	24.2	35
3/ 3/76	77	3.0	304	281	0	0	21.9	20	0.6	1	525	485	24.4	23
AVERAGE	50	2.3	304	184	0	0	19.2	12	0.6	0	558	338	21.0	13

NOTE ***=NO DATA AVAILABLE

STATION NO. 4679

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	4	3.6	537	26	0	0	30.0	1	*****	*****	963	46	45.4	2
12/11/75	8	3.4	340	33	0	0	19.2	2	5.5	1	575	55	37.8	4
12/17/75	4	3.3	534	26	0	0	27.5	1	1.1	0	1175	56	40.0	2
12/23/75	3	3.5	498	18	0	0	20.0	1	3.5	0	1075	39	80.0	3
12/30/75	5	3.4	392	24	0	0	27.5	2	1.6	0	1025	62	42.4	3
1/ 6/76	4	3.3	700	34	0	0	41.3	2	6.0	0	975	47	40.0	2
1/12/76	4	3.4	672	32	0	0	37.0	2	8.5	0	1075	52	41.0	2
1/27/76	5	2.4	302	18	0	0	22.5	1	8.8	1	900	54	33.0	2
2/ 5/76	8	3.1	356	34	0	0	26.0	2	0.7	0	862	83	48.0	5
2/11/76	6	2.9	310	22	0	0	21.3	2	8.0	1	670	48	28.6	2
2/17/76	8	3.4	228	22	0	0	18.0	2	10.0	1	788	76	22.6	2
2/26/76	6	2.5	336	24	0	0	35.0	3	0.7	0	670	48	37.8	3
3/ 3/76	5	3.6	296	18	0	0	36.0	2	8.5	1	738	44	28.6	2
AVERAGE	5	3.0	393	25	0	0	26.8	2	5.4	0	845	55	38.4	2

STATION NO. 4680

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	6	2.6	1001	72	0	0	114.4	8	*****	*****	1213	87	81.3	6
12/11/75	3	2.6	972	35	0	0	90.0	3	2.0	0	1200	43	80.0	3
12/17/75	5	2.7	1168	70	0	0	127.5	8	3.0	0	1375	83	122.5	7
12/23/75	14	2.9	1018	171	0	0	135.0	23	0.6	0	1500	252	75.0	13
12/30/75	18	2.7	904	195	0	0	82.5	18	2.5	1	1375	297	43.0	9
1/ 6/76	64	2.7	986	758	0	0	108.8	84	1.5	1	475	365	49.0	38
1/12/76	93	2.9	766	856	0	0	90.0	101	2.0	2	1375	1536	49.0	55
1/27/76	38	2.1	740	338	0	0	83.0	38	1.5	1	1125	513	49.0	22
2/ 5/76	24	2.1	780	225	0	0	70.0	20	1.2	0	1100	317	49.0	14
2/11/76	19	2.1	738	168	0	0	73.0	17	1.5	0	900	205	49.0	11
2/17/76	21	1.9	662	167	0	0	81.0	20	1.2	0	1000	252	49.0	12
2/26/76	60	1.9	740	533	0	0	76.0	55	1.2	1	874	630	65.0	47
3/ 3/76	35	1.3	942	396	0	0	96.0	40	1.0	0	1000	420	37.8	16
AVERAGE	31	2.1	829	306	0	0	90.4	33	1.6	1	1041	385	52.7	19

NOTE ***=NO DATA AVAILABLE

STATION NO. 4681

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/11/75	67	3.0	730	587	0	0	55.0	44	10.0	8	1075	865	58.0	47
12/17/75	86	3.3	542	560	0	0	55.0	57	1.2	1	1300	1343	80.0	83
12/23/75	50	3.5	542	325	0	0	37.5	23	8.0	5	1175	706	52.0	31
12/30/75	110	3.7	210	277	0	0	35.0	46	0.6	1	550	727	21.0	28
1/ 6/76	63	3.5	696	527	0	0	57.5	44	7.0	5	1125	851	46.8	35
1/12/76	55	3.7	328	217	0	0	55.0	36	17.5	12	1125	743	33.0	22
1/27/76	92	2.9	376	415	0	0	48.0	53	0.9	1	912	1008	48.0	53
2/ 5/76	39	3.0	416	195	0	0	46.0	22	0.9	0	1062	497	47.0	22
2/11/76	75	2.5	372	335	0	0	41.5	37	17.5	16	820	739	42.5	38
2/17/76	75	2.7	344	310	0	0	46.0	41	20.0	18	938	845	33.0	30
2/26/76	33	2.5	384	152	0	0	90.0	36	0.8	0	820	325	47.0	19
3/ 3/76	59	3.2	408	289	0	0	50.0	35	0.8	1	1025	726	33.0	23
AVERAGE	67	2.9	434	349	0	0	49.1	40	7.0	6	971	781	44.6	36

STATION NO. 4682

DATE	FLOW	PH	ACIDITY CONC	ACIDITY LOAD	ALKALINITY CONC	ALKALINITY LOAD	TOTAL IRON CONC	TOTAL IRON LOAD	FERROUS IRON CONC	FERROUS IRON LOAD	SULFATES CONC	SULFATES LOAD	ALUMINUM CONC	ALUMINUM LOAD
12/ 5/75	30	3.5	450	162	0	0	17.5	6	*****	*****	1075	387	41.8	15
12/11/75	76	3.2	520	475	0	0	24.4	22	3.0	3	863	788	48.0	44
12/17/75	31	3.4	604	225	0	0	5.1	2	0.3	0	1000	372	21.8	8
12/23/75	49	3.7	340	200	0	0	28.8	17	3.0	2	975	574	37.8	22
12/30/75	90	4.6	110	119	2	2	12.3	13	0.3	0	200	216	7.7	8
1/ 6/76	39	3.6	544	255	0	0	25.0	12	3.0	1	975	457	22.6	11
1/12/76	23	3.7	476	131	0	0	23.0	6	5.5	2	975	269	28.6	8
1/27/76	65	3.3	202	158	0	0	19.5	15	4.8	4	625	488	23.4	18
2/ 5/76	67	3.2	480	386	0	0	19.5	16	3.0	2	888	715	37.8	30
2/11/76	126	3.6	204	309	0	0	20.0	30	0.3	0	675	1021	20.8	31
2/17/76	120	3.8	158	228	0	0	16.7	24	7.5	11	712	1024	21.8	31
2/26/76	84	2.6	282	284	0	0	30.5	31	0.3	0	812	819	28.6	29
3/ 3/76	76	3.5	226	206	0	0	20.0	18	0.4	0	738	674	20.0	18
AVERAGE	67	3.3	298	241	0	0	20.3	16	2.7	2	742	600	26.1	21

NOTE ***=NO DATA AVAILABLE

STATION NO. 4683

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 3/75	20	3.5	404	97	0	0	6.6	2	*****	*****	963	231	24.2	6
12/11/75	33	2.9	634	251	0	0	5.5	2	0.7	0	713	283	42.4	17
12/17/75	40	3.2	560	269	0	0	6.2	3	0.5	0	1000	480	47.0	23
12/23/75	38	3.3	276	126	0	0	5.3	2	0.4	0	800	365	21.8	10
12/31/75	60	3.4	384	277	0	0	4.0	3	0.3	0	750	540	20.0	14
1/ 6/76	218	3.2	372	974	0	0	4.9	13	0.3	1	600	1571	16.0	42
1/12/76	171	3.1	384	789	0	0	4.3	9	0.3	1	775	1592	21.0	43
1/29/76	247	2.3	200	593	0	0	5.9	18	1.5	4	600	1780	20.0	59
2/ 4/76	50	2.9	226	136	0	0	3.6	2	0.2	0	625	375	20.0	12
2/11/76	80	2.6	214	206	0	0	4.3	4	0.3	0	738	709	20.8	20
2/17/76	73	2.6	166	146	0	0	4.0	4	0.4	0	575	504	12.0	11
2/26/76	100	2.2	218	262	0	0	6.1	7	0.2	0	500	600	21.6	26
3/ 3/76	80	1.6	230	221	0	0	4.3	4	0.3	0	762	732	16.0	15
AVERAGE	93	2.4	299	334	0	0	5.0	6	0.6	1	672	751	20.5	23

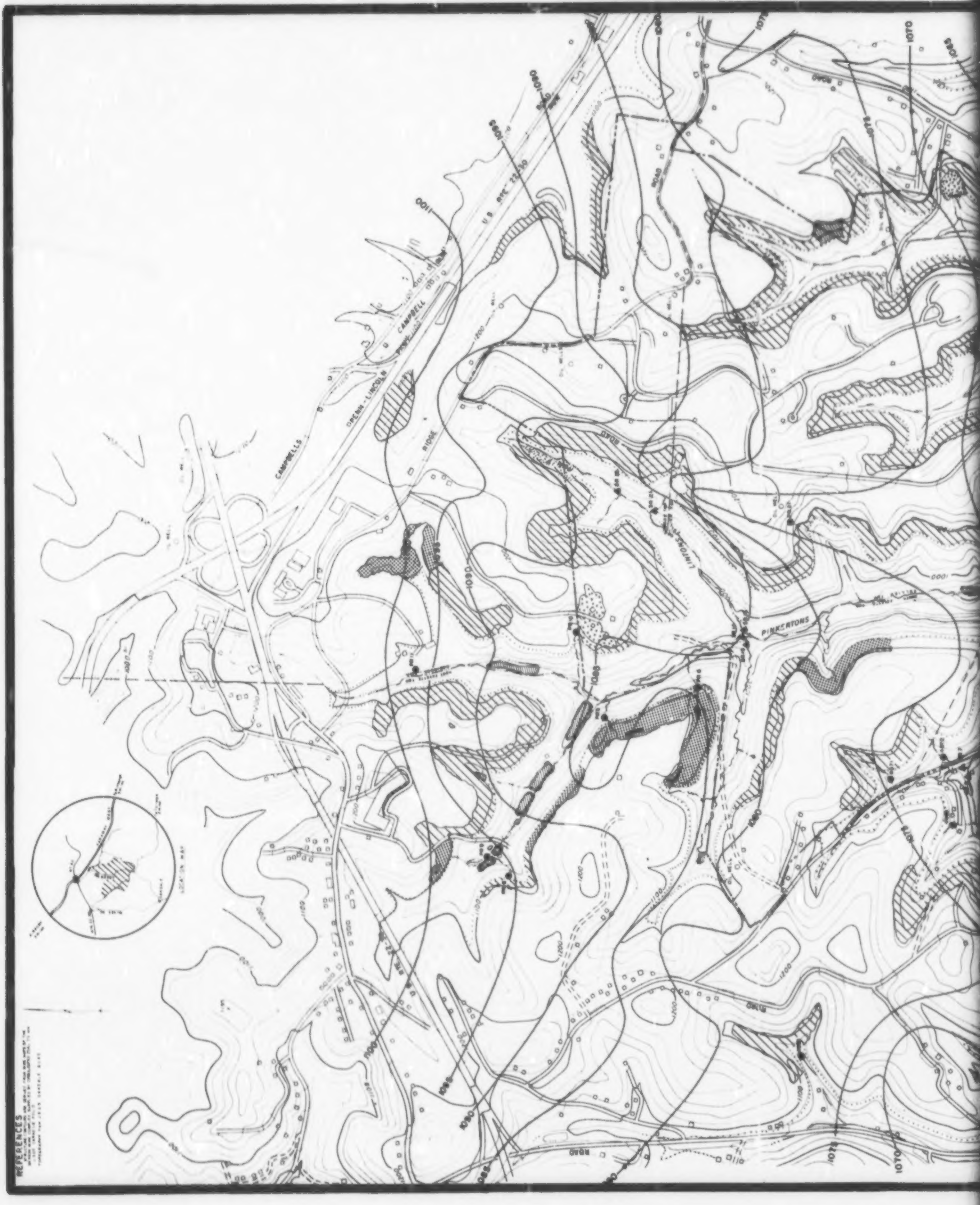
STATION NO. 4685

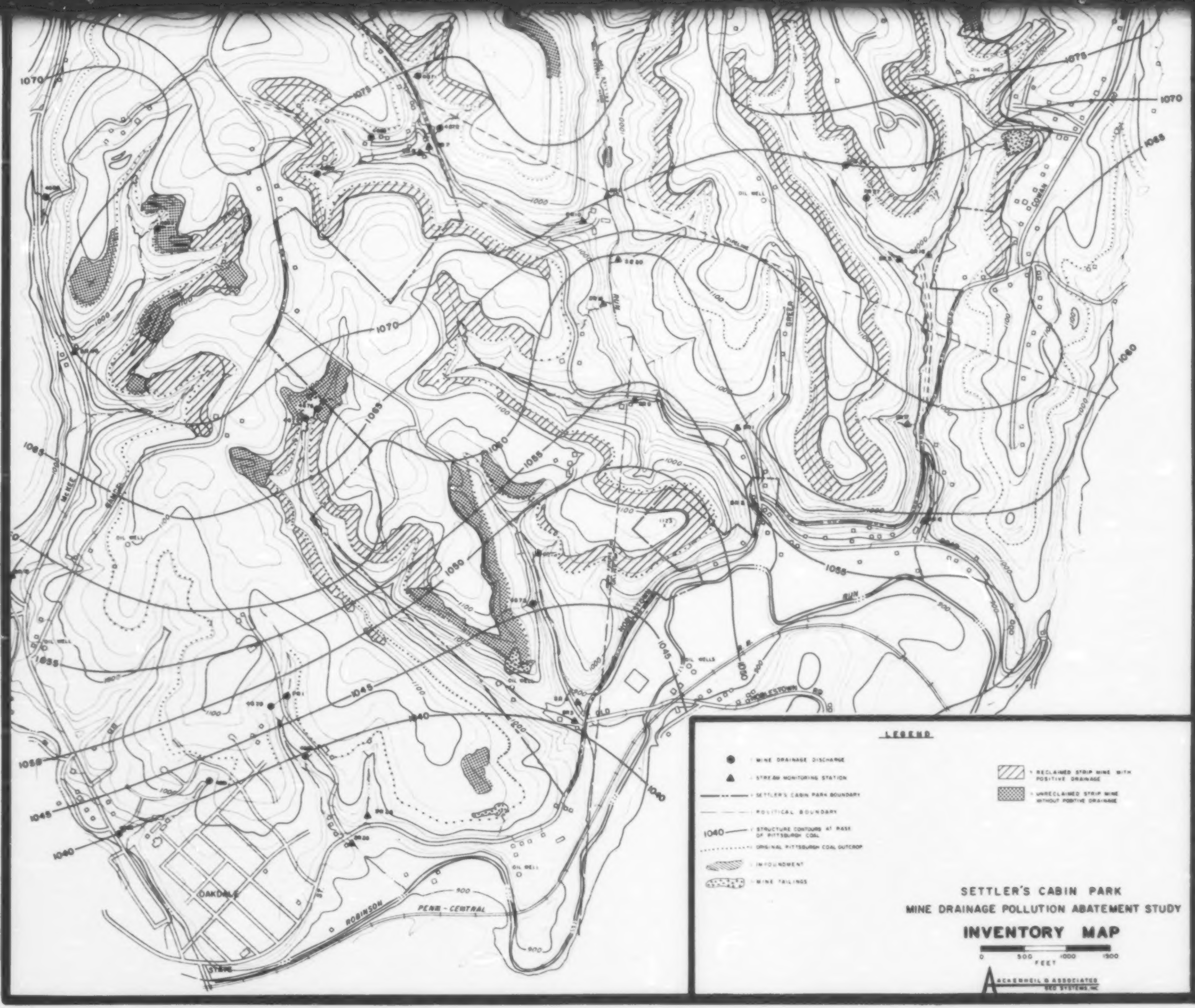
DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/ 5/75	63	3.6	282	213	0	0	4.3	3	*****	*****	912	690	22.5	17
12/11/75	57	3.7	474	324	0	0	4.0	3	0.4	0	763	522	22.6	15
12/17/75	63	3.8	487	368	0	0	19.3	15	0.5	0	938	710	42.4	32
12/23/75	96	3.9	222	256	0	0	22.6	26	0.4	0	950	1095	7.0	8
12/30/75	92	4.0	256	283	0	0	7.4	8	0.3	0	875	967	20.0	22
1/ 6/76	77	4.0	422	390	0	0	11.0	10	0.2	0	875	809	6.5	6
1/12/76	83	4.2	376	375	0	0	4.3	4	0.3	0	925	922	21.0	21
1/27/76	160	3.6	120	231	0	0	7.5	14	0.3	1	750	1441	16.0	31
2/ 5/76	77	3.3	200	185	0	0	4.9	5	0.1	0	738	682	20.0	18
2/11/76	120	4.0	126	182	0	0	4.3	6	0.1	0	738	1064	12.0	17
2/19/76	80	4.1	110	106	0	0	10.0	10	0.3	0	712	684	10.5	10
2/26/76	62	3.3	132	98	0	0	4.0	3	0.1	0	560	417	16.0	12
3/ 3/76	75	4.0	174	157	0	0	3.0	3	0.2	0	625	563	16.0	14
AVERAGE	85	3.7	239	244	0	0	8.3	8	0.3	0	796	813	16.9	17

NOTE ***=NO DATA AVAILABLE

STATION NO. 4688

DATE	FLOW	PH	ACIDITY		ALKALINITY		TOTAL IRON		FERROUS IRON		SULFATES		ALUMINUM	
			CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD	CONC	LOAD
12/11/75	38	3.3	392	179	0	0	1.4	1	0.2	0	350	160	20.8	9
12/17/75	50	3.3	296	178	0	0	2.6	2	0.2	0	500	300	20.0	12
12/23/75	63	3.5	200	151	0	0	2.3	2	0.2	0	525	397	16.0	12
12/30/75	130	3.5	136	212	0	0	7.9	12	0.1	0	425	664	12.2	19
1/ 6/76	193	3.3	300	695	0	0	3.0	7	0.3	1	500	1159	8.6	20
1/12/76	315	3.3	302	1142	0	0	1.7	6	0.2	1	1125	4256	8.6	33
1/27/76	244	2.8	158	463	0	0	1.7	5	0.2	1	475	1392	12.0	35
2/ 4/76	204	3.1	174	426	0	0	1.5	4	0.1	0	500	1225	11.0	27
2/11/76	200	2.8	170	408	0	0	1.4	3	0.1	0	462	1110	9.8	24
2/17/76	275	2.8	142	469	0	0	1.7	6	0.1	0	375	1239	9.8	32
2/25/76	363	2.5	*****	*****	0	0	2.0	9	0.1	0	575	2507	12.0	52
3/ 3/76	171	3.2	182	374	0	0	7.0	14	0.2	0	625	1284	16.0	33
AVERAGE	187	3.0	190	427	0	0	2.6	6	0.2	0	582	1308	11.4	26

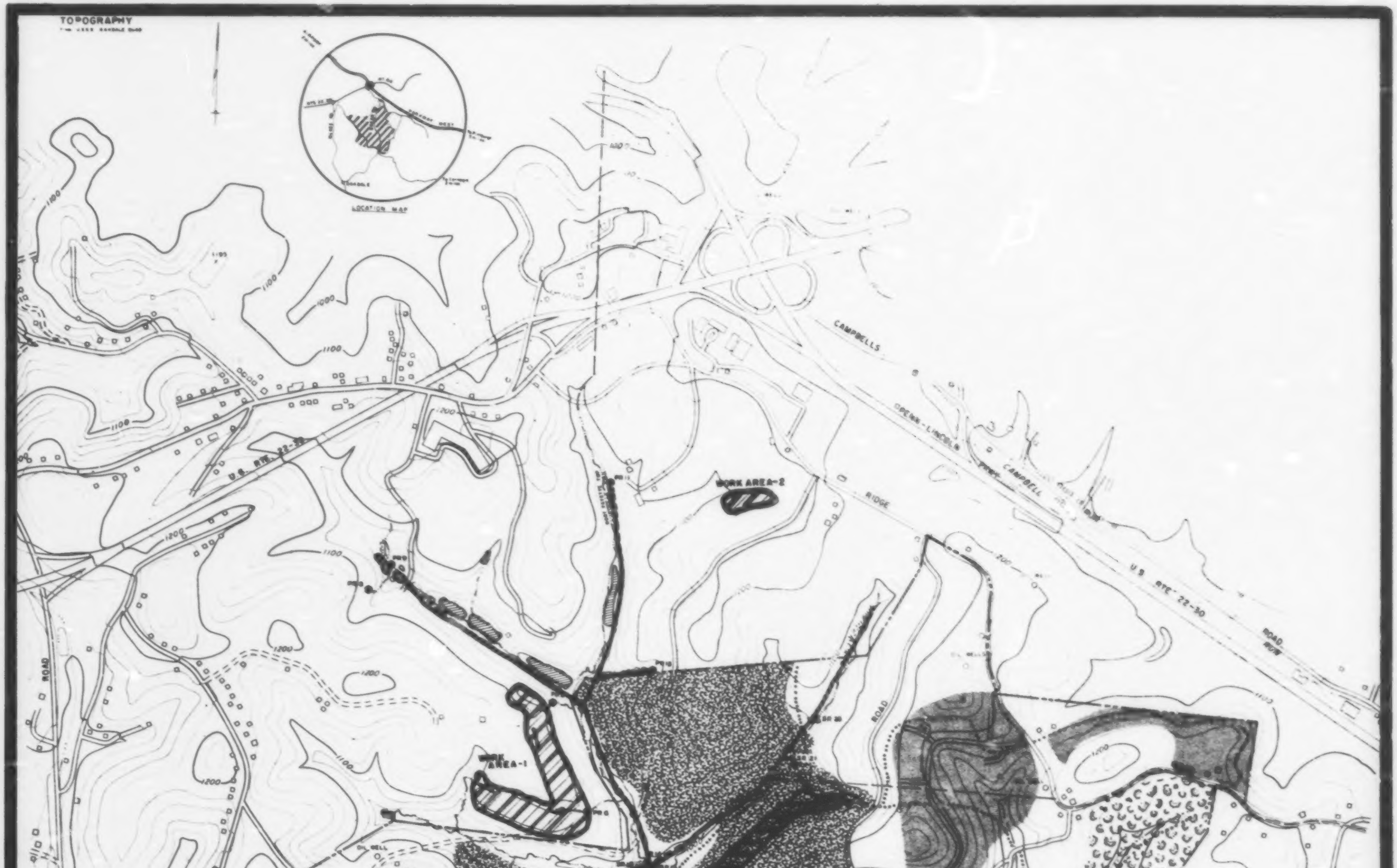

CAMPBELLS
CAMPBELL
RIDGE
PENN-LINCOLN PKWY
U.S. RTE. 22-30
PINKERTONS
ROAD
LOCATION MAP
REFERENCES
1100
1090
1085
1080
1075
1070
1200
1000

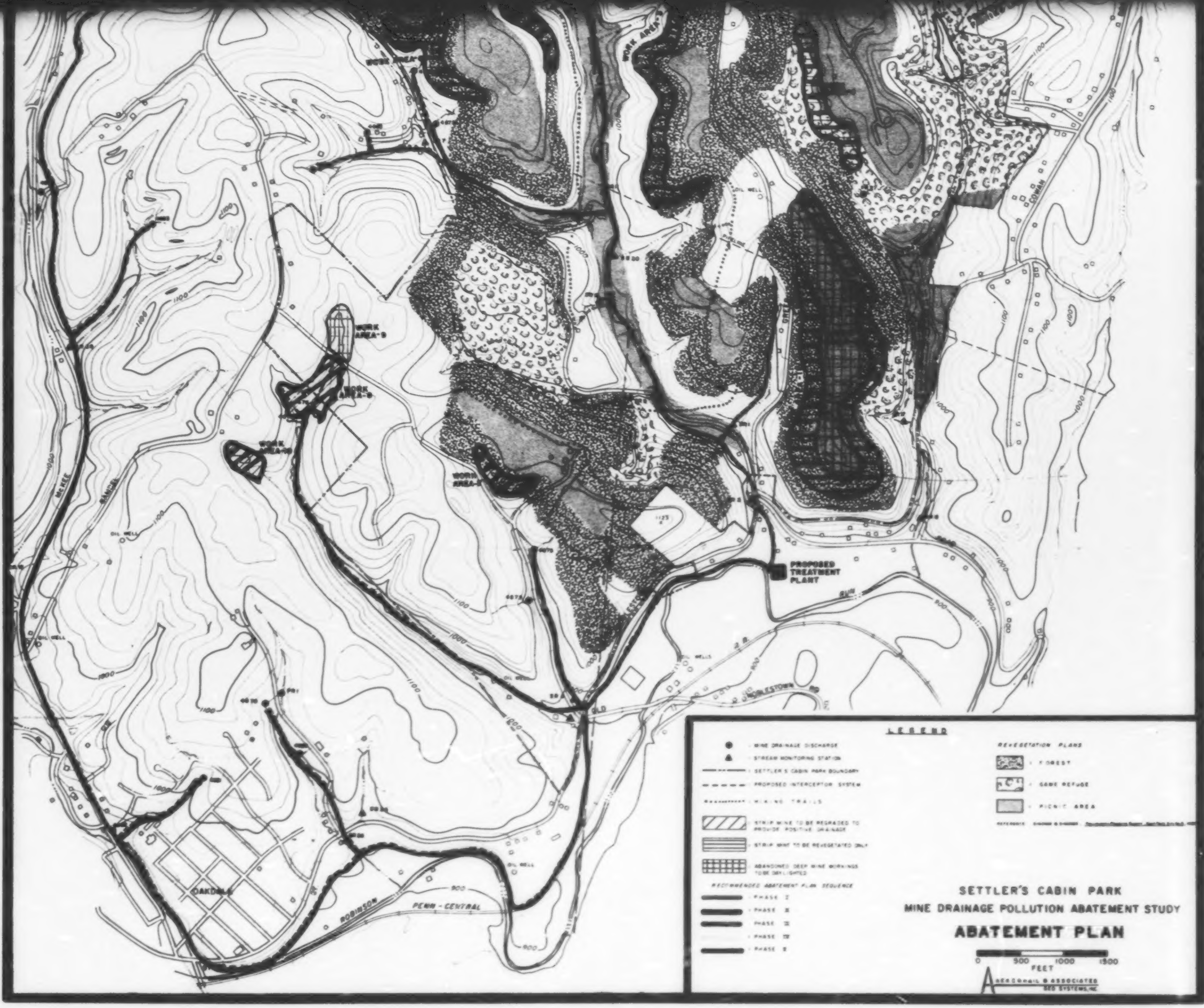

LEGEND
MINE DRAINAGE DISCHARGE
STREAM MONITORING STATION
SETTLER'S CABIN PARK BOUNDARY
POLITICAL BOUNDARY
1040 STRUCTURE CONTOURS AT BASE OF PITTSBURGH COAL
ORIGINAL PITTSBURGH COAL OUTCROP
IMPOUNDMENT
MINE TAILINGS
RECLAIMED STRIP MINE WITH POSITIVE DRAINAGE
UNRECLAIMED STRIP MINE WITHOUT POSITIVE DRAINAGE
0
500
1000
1500
FEET
ACKENHEIL & ASSOCIATES GEO SYSTEMS, INC
1070
1075
1065
1060
1055
1050
1045
1040
1000
1100
900
COWAN
GREER
PIPELINE
RUN
NOBLESTOWN RD
OIL WELL
OIL WELLS
McKEE
RANGE
RD
OAKDALE
ROBINSON
PENN - CENTRAL
ST.
R.R.

SETTLER'S CABIN PARK

MINE DRAINAGE POLLUTION ABATEMENT STUDY

INVENTORY MAP


TOPOGRAPHY
LOCATION MAP
CAMPBELLS
GREEN-LINCOLN
CAMPBELL
RIDGE
U.S. RTE. 22-30
ROAD
WORK AREA-1
WORK AREA-2
WORK AREA-3
WORK AREA
PROPOSED FISHING LAKE
1100
1200
1000


LEGEND
MINE DRAINAGE DISCHARGE
STREAM MONITORING STATION
SETTLER'S CABIN PARK BOUNDARY
PROPOSED INTERCEPTOR SYSTEM
HIKING TRAILS
STRIP MINE TO BE REGRADED TO PROVIDE POSITIVE DRAINAGE
STRIP MINE TO BE REVEGETATED ONLY
ABANDONED DEEP MINE WORKINGS TO BE DAYLIGHTED
RECOMMENDED ABATEMENT PLAN SEQUENCE
PHASE I
PHASE II
PHASE III
PHASE IV
PHASE V
REVEGETATION PLANS
FOREST
GAME REFUGE
PICNIC AREA
SETTLER'S CABIN PARK
MINE DRAINAGE POLLUTION ABATEMENT STUDY
ABATEMENT PLAN
0
500
1000
1500
FEET
ACKENHEIL & ASSOCIATES
GEO SYSTEMS, INC.
PROPOSED TREATMENT PLANT
WORK AREA-9
WORK AREA-8
OAKDALE
PENN - CENTRAL
ROBINSON
MCKEE
NOBLESTOWN RD
COWAN
OIL WELL
1000
1100
900